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Colonel JOHN DAVIS in the Chair.

WATER-TUBE BOILERS.

By J. T. MILTON, Esq.

THE CHAIRMAN: The subject of the paper is one of the very greatest national importance, and one that I know our lecturer, Mr. Milton, has given a great deal of attention and thought to. I am sure the paper he will read to-day will be of great value to the Mercantile Marine, and to the Navy. I will now ask Mr. Milton to read it.

WATER-Tube Boilers have been so much before the public lately that the writer feels some diffidence in again reading a paper on the subject, but in view of the fact that most of the water-tube boilers being made in this country are intended for war vessels, and also that some of the types of boilers seem to the writer to be only useful for such vessels, it is thought that a paper on the subject, followed by a discussion in this Institution, may elicit some points of importance which may lead to improvements in construction or management; or, at least, that by the paper and discussion being read by those who have not had the opportunity of being present at other meetings where these boilers have been discussed, the increased knowledge of their capabilities which may result will lead to greater confidence in the use of them.

In the present paper it is not intended to deal with all the types of water-tube boilers made, but mainly to confine the remarks to those types which are being actually used in British vessels; the only two types of boilers outside of these which will be noticed, being in the writer's opinion well worthy of consideration, on account of the good results which have been obtained with them in respect of economy of fuel—a point as to which, up to the present, water-tube boilers have not in general obtained a good reputation.

In comparing the suitability of different types of boiler for different services, it must be remembered that no one type of boiler ever has possessed, or is ever likely to possess, all-round advantages over other types, and the decision in favour of any one type for any special service will always

be in the nature of a compromise between the advantages and disadvantages which it possesses as compared with other types. This being so, it is useless to try to determine which is the best type of boiler for general or for all services.

Further, it is well to remember that when any one type of boiler has come into general use for any special purpose, in view of the fact that the most successful working of any type is only possible through the skill obtained by experience with that type, and also considering the natural tendency to place more confidence in the tried and known than in the untried, or experimental, it is only possible for another type to supplant it by its possessing manifest advantages over the older form.

The older forms, therefore, possessing the advantage of having been used for many years, their good points well known and appreciated, their weak points also well known and avoided as far as possible, or carefully watched and provided for, will not be likely to be disused, except it can be shown that the newer forms possess marked advantages which cannot possibly be obtained by the older, and which at the same time do not necessarily involve difficulties which cannot reasonably be overcome by skilled management. If, however, new forms are used it may be confidently expected that as experience is gained with them better results will be eventually obtained from them than can be realised at first.

In the Merchant Service the boilers almost universally used are cylindrical with internally fired furnaces and smoke-tubes. The pressure is usually 160 lbs. per square inch, although in a few cases 200 lbs. per square inch has been employed. As heavy repairs to, or renewals of these boilers, are serious matters, it is a *sine quâ non* that they should last for many years, but it is an equally important consideration that they should be economical in fuel consumption. This, indeed, is the motive which has led to the gradual increase of steam pressure to the present point, which many engineers consider to be nearly the maximum which can be obtained with this type of boiler. (It may, perhaps, be of interest to know that one of our enterprising engineers is about to construct boilers of the ordinary type to work at 250 lbs. per square inch.) If water-tube boilers are to supersede the present in merchant steamers, they will have to be shown to be at least as economical in fuel consumption in proportion to the evaporation obtained, and then new types of engines must be made to properly utilise the higher pressures of steam the water-tube boilers will render available.

In the majority of merchant vessels—in fact, in all but the large and powerful mail boats—the space occupied by the boilers, and also their weight are not matters of great importance. In the Royal Navy, however, the conditions are very different in all classes of vessel, while in some cases the necessity of obtaining great power from small space and weight appears to be of greater moment than any question of economy of fuel, or even of prolonged durability of boiler. It is owing to these conditions that the water-tube boilers are now so largely adopted. It is recognised that if it had not been for these boilers the type of vessel known as

Torpedo-boat Destroyers would not have existed, while a comparison of the performances of H.M.S. "Speedy," with those of her consorts, shows also that, so far as power and speed are concerned, the water-tube boilers fitted in her give results which cannot be obtained from even the lightest types of smoke-tube boilers.

Another point as to which the requirements of merchant ships are different in degree from those of war vessels, is the great importance in the latter of the boilers being easily and quickly repaired by the vessel's own complement, in case of damage, and also the necessity of limiting the quantity of hot water and steam they contain under working conditions, in order to minimise the damage resulting from a boiler or steam pipe being struck by missiles, etc. In these respects the ordinary cylindrical boiler cannot compare with any of the water-tube boilers.

Before describing the particular types of boilers it will be well to mention some general requirements of boilers, and then while considering each type it will be easy to see whether it provides for these in a greater or less degree.

1. Not only must the boilers be sufficiently strong to withstand the ordinary working pressure, and also possess some margin of strength, so that their efficiency may not be impaired when some of the parts become slightly thinned by corrosion, but their forms must be such that they can withstand the effects of expansion and contraction due to the changes of temperature to which they are subject. And this, not only as a whole, but the range of temperature to which separate parts of the boiler may be subject must not produce strains which may endanger the boiler, start leaks, etc. Much of the trouble given by ordinary boilers is due to these causes.

2. The fire-places, flues, etc., of the boilers should be so formed as to permit of as nearly perfect combustion of the fuel as possible.

3. The heat-absorbing surfaces should be so disposed as to transfer the greatest quantity of heat from the products of combustion to the water or steam in the boiler. One condition for this is that there must be no chance for the products of combustion to short circuit to the chimney without coming into contact with all the heating surfaces.

The following descriptions of different types of boilers are mainly taken from papers read by the writer at the Institution of Naval Architects in July, 1893, and March, 1894.

The Belleville Boiler, the general design of which shown in Fig. 1, consists of a series of sets of tubes placed side by side over the fire and enclosed in non-conducting casings. For convenience these boilers are usually placed back to back, thus doing away with the casings at the back, but this is not essential. Each set of tubes, called an element, is constructed in the form of a flattened spiral, and consists of a number of straight tubes connected at the ends by means of screwed joints to junction boxes. The junction boxes at either end of each

element are placed vertically over one another, and are so constructed that the upper end of one tube is on the same level as the lower end of the next tube in the spiral. The upper and lower surfaces of these boxes are machined so as to perfectly fit one another in such a way, that, while no side motion is possible, there is perfect freedom for movement endways in the direction of the tube length, thus providing for irregular expansion of the tubes comprising an element, or for the screwed threads at the ends of the tubes not being perfectly continuous. The junction-boxes at the back ends are close ended, but those of the front ends each have two oval holes in them opposite the tube ends, the holes being closed when in use by doors similar to, but of course smaller than, ordinary manhole doors. By removing the doors an examination of the inside of every tube may be made by means of an electric lamp fixed to the end of a rod. The tubes used in boilers for war vessels are generally 3¼ inches outside diameter, the spaces between adjacent tubes being 1 inch horizontally, and 1¼ inches vertically. Larger tubes are employed in merchant vessel boilers where the question of weight is not so important. The largest are about 5 inches diameter, the spaces between them being 1¼ inches horizontally, and 2 inches vertically. The thickness of the 5-inch tubes is usually ¼ inch, except in the cases of the two bottom rows, which are made about ⅜ inch.

The lower box of each element is connected by means of a bolted joint to a horizontal cross tube at the front of the boiler called the "feed collecting tube," and the upper box is connected also by a bolted joint to the bottom of the steam receiver, which latter is a horizontal cylinder running along the front of the boiler above the casing. At the junction of each element a nozzle projects inside the steam chest, directing upwards the current of steam and water which flows from the element. A series of dash plates is fitted along the receiver above these nozzles for the purpose of separating the water from the steam.

An outside circulating pipe is fitted at one end, connecting the bottom of the steam chest with a "separating chamber," which in its turn is connected to the "feed collecting tube." The boiler feed, as delivered by the feed pump, enters the steam chest at the end opposite to that to which the circulating pipe is attached. Circulation takes place by each element receiving a supply of water from the feed collecting tube into the bottom tube. This water is partially evaporated in the lower tube, and passes partly as steam, partly as water, through the back junction-box into the next tube, where a further portion is evaporated, and so on. Each tube, therefore, has to convey all the steam formed in the tubes of the same element which are below it, as well as the steam formed within itself. A mixture of steam and water is thus continuously discharged from each element into the receiver. The water so circulated, mixed with the feed water, passes along the bottom of the receiver, through the external circulating pipe, thence into feed collecting tube, to be again circulated through the elements.

The total quantity of water in this boiler under working conditions would, if there were no ebullition, be about sufficient to fill the lower hal

of the elements; the ebullition, however, in ordinary working, causes some of the water to circulate through the upper tubes into the steam receivers, so that none of the tubes are worked dry, and are thus not liable to overheating.

The employment of the separating chamber is peculiar to this boiler, and together with the method of feeding is the outcome of prolonged experience. The feed is delivered into the steam space, as has already been stated. It is supplied through very small pipes, in which, therefore, the pressure must be very great, and the velocity of the water very high compared with the practice with ordinary boilers. The opening of the feed valve is adjusted automatically by means of a float by the actual water level in the circulating pipe, so that if the quantity of water in the boiler becomes less the valve is opened wider, and *vice versâ*. The actual position of the float can be ascertained from the stokehold, so that by means of the float mechanism it is possible to work the boilers safely without glass water-gauges, which however are always fitted. When the feed has entered the boiler, it has to pass along the whole length of the bottom of the steam receiver, where it becomes mingled with the mixture of steam and water issuing from the elements, and its temperature must therefore be raised to that of ebullition before it enters the circulating pipe. It is usual to treat the feed water with a small quantity of lime, and at this temperature the lime so added, and also any lime salts which may be present in the feed, from any possible contamination from sea-water through leaky condensers, etc., separate out in a solid but non-crystallisable form, which being in an extremely fine state of division is stated to become mixed with the oil particles which may be in the feed, and to form a kind of mud, which separates and falls to the bottom of the separating chamber owing to the water being comparatively quiescent at that part. The feed water is thus purified before it enters the parts of the boiler which form the heating surfaces, which therefore do not become encrusted. Experience shows that this action does take place to a considerable extent, but probably some portion of the impurities escape precipitation in the separating chamber.

The ease with which repairs to these boilers may be effected is shown from the fact that a boiler may be shut off, its steam blown off, the water emptied from it, any one element disconnected and brought into the stokehold, and any one tube taken out and replaced by a new one; the element again connected, the boiler refilled, and steam again raised in about six hours, the whole work being done by one skilled engineer, assisted by firemen.

These boilers may be made either of large or small size, as any number of elements may be used, from four, as a minimum, up to a much larger number. This is a distinct advantage, as in vessels of comparatively small power, the boilers may be sub-divided as much as desirable in order to suit auxiliary purposes; while with large powers large boilers may be used, instead of more numerous small ones, which would involve more complication with feed and steam pipes, valves, etc.

The fire grate is placed below the collection of tubes, and the products of combustion rise up directly from the fire amongst them, and thence go straight to the funnel. The tubes are arranged vertically over one another, the spaces between the vertical rows varying in width from 1 inch in those boilers with the smaller tubes, to 1¼ inches in those with the larger. These spaces extend in direct lines from the fire grate up to the chimney; and it is evident that if it were not for baffle plates suitably disposed, some part of the products of combustion would traverse these spaces without actually coming into contact with the tubes. As it is, with the exception of the bottom tubes, the whole of the tubes are somewhat shielded from the heat by the tubes immediately below them. It will be seen that in some other boilers the tubes are arranged differently.

In order to obtain a thorough commingling of the furnace gases, and thus to secure complete combustion in the furnace before the gases enter between the tubes and get cooled below the critical temperature of ignition, jets of air under pressure are projected across the furnace above the grate from orifices in a pipe which passes along the front of the boiler immediately under the feed collecting tube. The pressure of air maintained in this pipe is varied to suit the different rates of combustion, and the different kinds of coal employed.

The increase of efficiency due to these air jets must be very marked, judging from the results obtained, as shown in the appendix, compared with those obtained from the Lagrafel boiler, to which reference will be made, in which a similar disposition of tube surface and circulation of furnace gases was used, but in which nothing was done to promote completeness of combustion.

These boilers are always worked at a considerably increased pressure above that used at the engine, the supply to which is regulated by an automatic reducing valve, regulated by means of springs, and so constructed that a constant pressure only reaches the engines so long as the boiler pressure exceeds that to which the valve is adjusted. If the boiler pressure falls below this, the valve opens fully and allows the whole of the boiler pressure to reach the engine.

The variation between the engine pressure and the full boiler pressure is, therefore, a kind of reserve of steam, so that practically, although the steam space proper is very small compared with that usual in cylindrical boilers, very considerably more variation in the rate of combustion can take place before it makes itself apparent by affecting the speed of the engine.

The water-tube boiler which has been fitted into the largest number of British merchant vessels is the Babcock and Wilcox boiler. These have been fitted into the s.s. "Nero," and "Hero," belonging to the Wilson Line, and have been, or are being fitted into three vessels built by Messrs. Doxford, of Sunderland. Fig. 2 shows a boiler of this type fitted into the French s.s. "Algérie," a vessel of 1,282 tons.

These boilers are modifications of the well-known land boiler, made

by the same firm. Each boiler consists of a steam receiver (sometimes of two receivers placed one above the other), placed above the nests of tubes, and a series of nests of tubes connecting the "headers." The headers are forged steel boxes of sinuous form, the ascending and descending headers being connected to each other by the tubes. The sinuous form enables the tubes of each horizontal row, or in the case of the sets of four small tubes, each set of four to be placed above the spaces between the tubes, etc., of the row immediately below them. The products of combustion are, therefore, brought more immediately in contact with the heating surfaces than they would be if the headers were straight, and the tubes arranged vertically over one another. The tubes are arranged to have a rise of about one in four, in order to cause a circulation.

The upper ends of the headers are connected to the steam chest by separate pipes, and the working water level is maintained at about the centre of the receiver. The circulation takes place from the receiver, down the back headers, through the tubes, and up the front headers into the steam chest again. The side headers are made straight instead of sinuous, the connecting tubes in them are vertically over one another. This is done in order to protect the casings as much as possible from the heat of the fire. The casings are made of sheet-iron, lined with non-conducting substances, and further protected outside by an air casing. The fronts and backs of the boilers are fitted with doors with air casings, like ordinary-smoke-box doors for giving access to the tube ends.

The lower parts of the back headers are connected by short tubes, with a cross pipe, to which the blow-off is attached.

In these boilers all the tubes are connected to the headers by ordinary roller-expanded joints, the expanders being worked through holes similar to the tube holes on the opposite side of the header, there being one hole provided opposite every tube end. These holes are closed by special doors. In the case of the doors opposite the large tubes, the plug is put in from the outside, and the screw is forged solid with it, the joint is made on the outside by means of the cap, the nut is close ended so that two metallic faced joints are made, viz., between the nut and the cap, and between the cap and header. In the case of the small tubes the plugs are made conical, and are put in from the inside, and they form the joint, so that one joint only is made for each door.

The headers are connected to the steam chest, cross pipe, and, where they are used two deep, to one another by expanded nipple joints. It will be seen that the greatest confidence is placed in the tightness and strength of the expanded joint, no screwed stay tube being used throughout the boiler; the tube ends are, however, all slightly bell-mouthed after expanding.

It will be seen from the figure that the products of combustion on leaving the fire pass amongst the lower set of large tubes, and then into a space or combustion chamber before entering amongst the small tubes, the object being to give a better chance of more complete combustion

than would be obtained if they entered at once amongst the mass of small tubes. This arrangement was not adopted in the "Nero's" boilers, and in the latest type it has been further developed, the arrangement being that in the lower headers there are, commencing from the bottom, first one tube, then a space made by leaving out three tubes, then three more tubes are fitted, and finally the space formed by the distance between the two headers, as in the "Algérie's" boiler, this space being equal to that which would be occupied by two tubes. It is expected that the advantage of having these spaces will more than counterbalance the disadvantage of the necessarily increased height of the boiler.

It is to be regretted that no absolutely definite results are available as to the evaporative efficiency of this type of boiler, there having been no opportunity in either vessel in which they have been fitted of making carefully conducted experiments; but in the cases both of "Nero" and "Algérie" actual working shows that they are at least as economical as ordinary cylindrical boilers.

Up to the present time none of these boilers have been worked with forced draught.

The Fleming and Ferguson boiler, as fitted to the s.s. "Aberdeen," a vessel of 674 tons, belonging to the Canadian Government, is shown in Fig. 3.

The vessel is fitted with two boilers placed side by side. The steam-chest of each is 6 feet diameter; the water chambers are 3 feet diameter. These extend the whole length of the boiler and are connected, as shown, by numerous bent tubes. The chambers are connected outside the boiler by large circulating pipes, and the circulation of water is from the steam-chest through these pipes into the water chambers, up through the bent tubes into the steam-chest again. The tubes used are lap-welded wrought iron, $2\frac{1}{2}$ inches external diameter, enlarged at the upper end to $2\frac{9}{16}$, to enable them to be passed through the tube holes from the inside of the steam-chest. The diameter of steam-chest is sufficient to allow the longest tube used to be put in in this way, so that the renewal of a tube is a comparatively easy matter. The tubes are expanded into the plates of the steam and water cylinders, and then beaded over at the ends, no screwed or nutted stay tubes being used.

In any particular row the space between the tubes is a little more than the diameter of the tubes, and it will be noticed that the tubes immediately above the fire cross one another. The products of combustion rising from the fire get commingled in passing through the spaces between these tubes. In order to provide for the proper distribution of the furnace gases amongst the tubes, baffle plates are fitted.

The s.s. "Aberdeen" has now been running for ten months, and up to the present has given satisfaction, both as regards fuel consumption and also as to the working of the boilers. Natural draught only is used on this vessel.

Messrs. Anderson and Lyall have fitted a small vessel—the s.s.

"Thetis," 339 tons—with their patent boiler, the general design of which is shown in Fig. 4.

This boiler can scarcely be called a water-tube boiler, as it combines the use of both water-tubes and smoke-tubes. The figure shows the fire-grate situated below the set of water-tubes, which are comparatively widely spaced. The products of combustion pass beneath and around these tubes into the space above them and below the cylindrical barrel containing the smoke-tubes, and thence into the combustion chamber proper before passing into the smoke-tubes. This arrangement gives ample opportunity for the furnace gases to become properly mixed and burned before they become too much cooled by contact with the tubes.

This boiler appears to have a high evaporation efficiency, as proved by a test made by my colleague Mr. Stromeyer, of Glasgow, the results of which are given in the appendix.

A boiler adopted in the French Navy, and fitted in the "Friant," "Charles Martel," "Élan," and other vessels, is that illustrated by Fig. 5, known as the Niclausse boiler, made by the Compagnie anonyme des Générateurs Inexplosibles, of Paris.

The boiler consists of a series of headers fitted side by side, each having a number of compound tubes fitted to it, the whole being placed above the fire and surrounded by a suitable casing. The headers each communicate at their upper open ends, with the bottom of a horizontal cylindrical chest which, when in work, contains steam and water, the water-level being at about its centre.

The headers are made of malleable cast iron, and are each constructed with a centre diaphragm dividing it into two portions, the inner serving as an upcast for the mixture of steam and water issuing from the generating tubes, the outer forming a space for the descending water.

For each tube holes are bored through the front and back of the header, and through the diaphragm of nearly equal diameter; those in the two outer walls of the header being slightly conical or taper, the smaller end of the hole in the outer wall being of exactly the same diameter as the larger end of the hole in the inner wall.

The steam-generating tubes are reduced in size at the rear end, and are closed by iron cap nuts screwed on to them, the nuts being slightly smaller than the diameter of the tubes. The front ends of the tubes are secured to malleable iron castings, termed by the makers "lanternes." These lanternes are turned with conical surfaces where they fit the walls of the headers. The parts near the tubes which fit the back wall are thick and rigid; the front ends, however, are made thinner, to give more elasticity. The lanternes are all turned to gauge, so as to be absolutely interchangeable. The middle part of the lanterne fits easily into the hole in the diaphragm; its shell is cut away at top and bottom, so as to afford freedom for the motion of the water in circulating.

Inside the steam-generating tube is placed a smaller water-circulating tube, which is secured to a smaller lanterne fitted inside the other, but

extending only from the front of the header to the diaphragm. The front joint of this inner lanterne is screwed only.

The tubes are arranged in pairs, each pair being kept in place by a cross-girder fastened by a stud screwed into the header. The construction of these details is shown by the sketch in Fig. 5, drawn to a larger scale.

In practice it is found that the tubes are readily removable from the front of the boiler, and may be replaced quickly, the boiler thus affording exceptional facilities for cleaning and inspection.

The tubes are arranged over the fire, as in the Belleville and Babcock and Wilcox boilers, and are so placed that each is directly over the space between those immediately beneath it, thus ensuring close contact between the heating surfaces and the furnace gases, which have to zig-zag amongst the tubes. As in the Belleville boiler, completeness of combustion is aimed at by introducing jets of air under pressure immediately above the fire, in order to produce a proper commingling of the furnace gases. In the appendix are given the results of evaporative trials made with various rates of combustion up to a forced draught rate of 35 lbs. of coal per square foot of grate per hour.

It will be seen that these boilers do not require any access to the sides or back, every part being easily got at from the front. Each tube being self-contained is absolutely free from any strain by expansion, and each header is also independent of its neighbours in this respect. The doors at the front of the boiler are necessarily cool, as they are protected from the heat of the fire by the headers.

The peculiar joint between the headers and tubes, and also the screwed joint between the inner and outer lanterne are most unusual in English practice, but experience with them shows that they are perfectly reliable, there being absolutely no difficulty with them even after many removals and replacements.

Messrs. Willans and Robinson, of Thames Ditton, have been experimenting with this boiler for a long time, and their favourable experience with it is given in a paper communicated to the Institution of Naval Architects during the present month by Mr. M. Robinson, of that firm.

The Lagrafel-D'Allest boiler, which is shown in Fig. 6, is made by the Forges et Chantiers de la Méditerranée at Marseilles, and by the Fréycinet Company of the same city. It possesses a certain resemblance to the Babcock and Wilcox boiler, but the separate headers of the latter are here replaced by two water chambers. These chambers are formed of plates retained in parallel, or nearly parallel, positions by means of numerous screw stays. They are closed at the bottom and sides, but open at the top into a cylindrical steam chest, which is nearly horizontal, sloping a little towards the back of the boiler. The chambers extend down to about the level of the fire-grate. They are con-

nected below the steam chest by means of a number of water-tubes, which form the main portion of the heating surface.

In the manufacture of this boiler, both plates of the chambers have to be pierced with as many holes as there are tubes, those in the outer plates being slightly larger than those in the inner, in order to allow of the tubes being easily put through them. The tubes are expanded into the inner or tube plates, access for this being obtained through the holes in outer plate. These latter are closed by specially-constructed doors, which are placed inside the boiler, each being secured by a bolt and cross-bar. Being inside the boiler, no mishap would occur if one of the bolts were to break. The door joints are made by thin asbestos washers and a ring of copper wire.

There are no stay tubes in this boiler. The tubes employed are usually 2¾ inches in diameter, and are pitched about 4 inches apart from centre to centre. They are easily inspected inside, owing to their being arranged with doors opposite both ends.

The working water level is a little above the bottom of the steam chest. The circulation takes place from the steam chest into the back water space through the tubes into the front water space, the mixture of steam and water then entering the steam chest, the water traversing the bottom of the steam chest, and then passing down the back water space again.

In working this boiler, it is usual, as with the Belleville boiler, to treat the feed-water with a small proportion of lime, and the deposit which takes place in the boiler is generally found in the lower part of the back water chamber, where the water is quiescent.

The feature which distinguishes this boiler from all others is the arrangement made for the circulation of the products of combustion amongst the tubes. The boilers are arranged in pairs, each part having its own feeding and water arrangement, but possessing one common combustion chamber, which is situated between the two nests of tubes.

The tubes are placed mainly over the fire, the bottom row being at a height of about 2 feet from the fire-bars. Over the bottom row, and resting on them, preventing the passage of the furnace gases up between and amongst the tubes, are placed a number of specially-shaped tiles, a similar set being placed upon the upper row. Baffle plates are fitted at the side smoke boxes to cover about the upper two-thirds of the spaces between the tubes. These arrangements compel the furnace gases to pass along under the bottom row of tubes into the combustion chamber, and from that space they travel horizontally between the tubes, finally emerging in the smoke boxes at nearly the bottom part. From the smoke boxes they pass under the steam chest to the chimney. It will be seen that the circulation of the gases is somewhat like that in an ordinary double-ended cylindrical smoke tube boiler; the employment of the combustion chamber giving the same chance of mixing and burning the furnace gases in the two kinds of boiler.

In the Lagrafel, which was the older type of this boiler, there was no combustion chamber, the products of combustion passing directly up between the tubes. It was found with the arrangement that the furnace gases did not get properly burned, as by passing them directly between the tubes they became cooled below the critical temperature at which union between the gases and the oxygen of the air takes place.

The appendix shows the great improvement in economy obtained by the use of the combustion chamber in the Lagrafel-D'Allest type; and a comparison between the Lagrafel results and those of the Belleville and Niclausse boilers shows the great value which must be attributed to the air jets in the latter boilers.

The Lagrafel-D'Allest boiler has been used in many French war vessels and in several French merchant vessels. The use of loose tiles laid upon the tubes is peculiar, and it is to be noted that any displacement of these would seriously affect the efficiency of the boiler, as it would permit of the "short circuiting" of the furnace gases into the chimney without parting with their heat to the heating surfaces.

The boiler appears to have one disadvantage in regard to its use in war vessels, where space is so important a factor, viz., it not only requires the ordinary space in the stokehold proper, but it also requires means of access along the sides to get to the doors provided for cleaning the tubes. The boilers, therefore, cannot be placed side by side. For cargo vessels, however, this would not be any disadvantage, as in them, owing to the peculiar tonnage laws, the extra space required can always be afforded.

In the boilers already referred to the tubes are made of comparatively large diameter, and most of them are also straight, so that their internal surfaces can be inspected, or at least it can always be readily seen whether they are free from obstruction, etc. Owing, however, to the demand for much lighter and more powerful boilers than those described, several other types have been used in special vessels.

In these the size of the individual tubes is small, and in consequence their thickness is much less than that of the larger tubes used in the other types of boiler. On this account, and also because of the relatively smaller amount of water they contain, the weight of the boilers in working conditions are much less than that of those previously described; but owing to the thinness of the tubes it cannot be reasonably expected that the boilers will be as durable as those in which larger and thicker tubes are used.

All these types possess some points of resemblance to one another. They all have horizontal steam chests and two or more horizontal water chambers connected to the steam chest by the heating tubes, the main differences between the types being in the forms and dispositions of the tubes.

In the Yarrow boiler, illustrated in Fig. 7, the tubes are all straight. In the earlier boilers of this type, outside circulating tubes were fitted, but in the later boilers these have been dispensed with. In the smaller

boilers the steam chest has been made in halves, bolted together, the upper half being removable for the purpose of examining and, if necessary, of replacing any tube. The lower chambers are always made with bolted joints.

In the case of replacement of any tubes, the lower plates of the lower chambers have to be taken off, and if the tube happens to be in one of the inner rows, those immediately outside of it have to be taken out to obtain access to the tube ; all can then be replaced. The tubes are fixed by being expanded by roller expanders. A few stay tubes are used, these being mainly required for structural purposes during the building of the boiler. The lower chambers are fitted with sight and sludge doors, through which any mud or deposit in the chambers may be removed.

The fire is placed between the two nests of tubes, and the products of combustion pass between all the tubes into the chimney. The tubes are arranged zig-zag, so that any one tube is opposite to the space between two in the adjoining row.

The casings of the boiler are made removable, so as to afford easy access for sweeping tubes, etc.

The Blechynden boiler is very similar to the Yarrow boiler in general features. It is shown in Fig. 8. The tubes instead of being straight are all curved; the two outer rows are brought to touch one another so as to form a "water wall" or insulator, for the protection of the casing from the heat of the fire. The other tubes are only slightly bent, the curvature being about 2 inches in their length. The upper, or steam chest, is furnished along its upper part with a series of holes closed by suitable doors. The tubes are replaceable by being drawn partly into the steam chest, and then out through the doors, the new tubes being replaced in a similar manner. No external circulating tubes are provided.

The Reed boiler is shown in Fig. 9. The tubes are bent as shown, and baffle plates are provided for circulating the furnace gases amongst them. External circulating tubes are provided at each end. A peculiarity in this boiler is the method adopted for securing the tubes, which instead of being expanded are secured by the peculiar screwed joint shown in the figure, these being used in order to permit a slight alteration of shape or lead of tube to take place without straining the tubes.

In the White boiler, as fitted in the latest vessels, shown in Fig. 10, there are two steam receivers, connected to one another by an independent steam pipe, and three water chambers, which are also connected to one another. The heating surfaces consist mainly of tubes formed into a series of double spirals, the lower ends being fixed to the water chambers and the upper to the steam chest. There are also other tubes, more nearly straight, connecting these chambers, and forming a "water wall," used for the purpose of directing the flow of the furnace gases in their passage through the boiler. The gases pass from the fire towards the back end of the boiler, enveloping and filling the spirals, returning the other side of the "wall," among the spirals placed there. The hottest gases are

thus found towards the middle of the section, and the cooler towards the outside.

It is considered that the commingling of the gases passing into and among the spirals, and the comparatively long passage of the gases amongst the heating surfaces, promote economy, both by improving the combustion and also by the more efficient absorption of the heat by the heating surfaces.

In this boiler outside circulating tubes are fitted.

In the Normand boiler, a cross section of which is shown in Fig. 11, it will be seen that none of the tubes are straight; even those which might have been made straight being made with more or less curvature, with the object of preventing expansion strains. In this boiler, as in the White boiler, the furnace gases are circulated amongst the tubes, instead of being forced straight past them into the chimney.

In all the boilers mentioned, the upper ends of the tubes have all entered into the lower half of the steam chest. In the Thornycroft boilers, shown in Fig. 12 and 13, and the tubes enter the upper half of the chest, the water and steam being deflected downwards by suitably shaped baffle plates.

In the older form of boiler, Fig. 13, which is the type fitted in the "Speedy," the tubes are symmetrically placed with regard to the fire. The two inner rows are brought together at a little distance from the fire level, and form a "water" diaphragm, or crown, to the furnace, and compel the furnace gases to all leave the furnace at the spaces towards the bottom of these tubes. The two outer rows also are brought together, as near to the bottom as possible, and are kept together to nearly the crown of the boiler, forming an insulation for the outer casing of the boiler. The spaces between these diaphragms form flues, through the whole length of which the furnace gases have to pass on their way from the fire to the chimney, enveloping the remainder of the heating surfaces. The feed enters the upper, or steam, cylinder, and there are outside circulating pipes bringing down the water, which circulates up the heating tubes into the steam chest, and then through these outside pipes into the lower water chambers again.

In the more recent boilers of the "Daring" type, shown in Fig. 12, the arrangement of tubes is different. There are three water chambers, the two smaller and outer being connected to the larger and central one. The outer small tubes are formed into a "water wall," or diaphragm, inside the casing. The downcast tubes for the return circulation of the water are arranged in the middle line, running from the bottom of the steam chest to the top of the water chamber.

If these boilers are arranged side by side, Mr. Thornycroft proposes to do away with the outer water chambers and "water wall," arranging the boilers with one steam chest and one water cylinder to each, one fire in this case being between two boilers.

Where a number of these boilers are fitted in one vessel, Mr. Thornycroft has found it to be advisable to regulate the feed automatically by means

of floats, as is done, although by different mechanism, in the Belleville boiler. The attention necessary for feeding the boilers is thus reduced to seeing that the mechanism is in order, instead of requiring frequent and careful adjustment of the different feed-check valves. There is no reason why similar arrangements should not be fitted in all cases where there are many boilers requiring attention.

In the Du Temple boiler, shown in Fig. 14, the heating tubes form a series of zig-zags from the lower water chambers to the upper steam chest. These tubes are smaller in diameter at the lower ends, and are secured there by means of a special kind of joint. Outside circulating tubes are also provided.

This type of boiler does not appear to have found so much favour as the others, only one vessel being fitted with it.

Having described those water-tube boilers which appear to find most favour amongst marine engineers, it may be well to make a few remarks as to their special requirements.

As these boilers contain so much less water than ordinary boilers of the same power, and as the free water level in them all is also of so much less extent, it is evident that very much less irregularity of feed is permissible in them than might be allowed with ordinary boilers without serious trouble occurring. This is specially important where more than one boiler is fitted to a vessel, and where, therefore, the water from the condensed steam does not automatically return to the same boiler from which the steam was taken. This difficulty, however, has been overcome in the Belleville boiler and by Mr. Thornycroft; and, as has been remarked, there is no reason why automatic feed regulators should not be adopted with any of these types of boiler.

These boilers also are necessarily curtailed in steam space, as compared with ordinary boilers, which, in addition to steam space proper, have the advantage of a large storage of heat in the large amount of water they contain, which heat is given off by evaporation of part of the water when a reduction of pressure occurs. In order, therefore, to maintain regularity of pressure in water-tube boilers very regular firing is necessary, and even with the greatest of care some fluctuation of pressure is inevitable. This is overcome in the Belleville boiler, and the steam supply made absolutely regular by the device of carrying higher steam pressures in the boilers than is used in the engines and by using the "reducing valve." There is no reason why similar devices should not be employed, if found to be desirable, with other boilers. It has been urged against this that it is bad engineering to reduce the steam pressure without taking work out of it, and that it would be better practice to use the steam in the engine with as high a pressure as it can be made. This would be perfectly true if the boiler pressure were as low as, say, 160 or 180 lbs., but is not true as a general proposition. Owing to the construction of water-tube boilers, there is practically not the same limit of pressure with the boiler as there is with the engine, and given any pressure at which it will be feasible to work an engine satisfactorily, it will be

possible to make a water-tube boiler to work at 50 or 100 lbs. still higher pressure with very little more cost or weight, because other considerations than strength alone fix the ordinary thicknesses of tubes, etc., while the furnace fittings, chimney, and accessories generally need not be any heavier for the increased pressure. If this principle is adopted, little difficulty will arise with the firing.

There is another difficulty however, and, in the writer's opinion, a much more serious one, viz., the necessity of using absolutely pure feed-water. With the advent of surface condensation, it became usual to speak of the feed as being fresh, but everyone who has had business with marine boilers knows the accumulation of scale which takes place in them, sometimes even when evaporators are fitted. The use of evaporators has much reduced the trouble, but trouble there always will be with scale, while surface condensers may leak, even with ordinary boilers and in spite of evaporators. In these boilers, however, the difficulty is not nearly so great as with water-tube boilers. When scale forms *outside* a tube, it is comparatively easily detached, but when it forms *inside*, it is extremely difficult to remove it. The reason probably is that the scale is deposited when the tubes are hot, and has to be cleaned off when they are cold. The contraction of the material of the tube in one case loosens the scale, but in the other it seems to hold it much tighter. Besides this, the surfaces, which become coated, are very much easier of access in the cylindrical than in the water-tube boiler.

An even worse enemy than scale due to sea water is grease. Attempts are made by using the very minimum quantity of oil in the cylinders and on the piston rods, and by employing grease filters, to clean the feed water, and so prevent the entry of grease into the boilers, but, in spite of all care, it gets there, and apparently, by becoming somewhat mixed with earthy matter from other impurities in the water, it forms a non-conducting film on the heating surfaces extremely difficult to remove. Many cases of collapsed furnaces and bulged plates have been due to this cause, and if similar deposits take place in water-tube boilers they also will give serious trouble. Scale and grease, if they are allowed to accumulate, will, in the cases of those boilers with small and curved tubes, necessitate the renewal of the tubes, while, even with large and straight tubes, the cleaning operation will be one of extreme difficulty.

While dealing with tubes, a few remarks may be offered as to the material of which they are made. Brass and copper have both been tried and neither is now used. Lap-welded iron tubes have been, and are being used in the Babcock and Wilcox, Fleming and Ferguson, and the Lyall boilers, and some of the Belleville boilers are also fitted with them. In others, lap-welded steel tubes have been used; preference is, however, given to seamless steel tubes, which are now universally used for the small tubes of the "Destroyers'" boilers, and they have also been used for Belleville boilers. I am informed that experience shows that the lower tubes of the D'Allest boilers stand best if made with internal ribs on the Serve principle.

The headers of the Babcock and Wilcox boiler and Niclausse boiler are of intricate form; the former are made of mild steel plates welded, the latter of malleable cast iron. The junction boxes, etc., of the Belleville boiler are also usually made of malleable cast iron, although in a few cases they have been made of cast steel. The prolonged experience of these boilers in France has shown malleable cast iron to be a very suitable material, as it can be readily made sound in the required shape, and possesses sufficient strength and a considerable amount of ductility. If the material is suitable for low steam pressures, it will also be found to be equally suitable for the higher pressures, to which there appears to be a tendency to move, as, with the greater pressures, increased thickness of parts will give only the same stress on the material, while the effect of the increase of temperature of evaporation will be very small indeed.

A very important point in deciding the suitability of any type of boiler for war-ship purposes is its suitability for forcing; in other words, its behaviour under forced or induced draught. At the present time there are many engineers who consider that forced draught should not be employed at all; but the importance of the matter, and its bearing upon war-ship engineering, may be seen by reference to some of the particulars given in the appendix. Take, for instance, those referring to the Niclausse boiler. If we take the first experiment recorded, in which the fuel consumed was 18·96 lbs. per square foot of grate, as being a good performance for natural draught, we see that the water evaporated per hour in the boiler, reckoned from and at 212°, is 4,030 lbs. By forced draught, burning 35 lbs. per square foot, the evaporation is increased to 6,454 lbs. That is to say, ten boilers working under these conditions will give as much steam as sixteen working under natural draught. To do so, however, the coal burnt will be about 15 per cent. more. This, of course, allows nothing for the steam used in driving the fans; but even allowing a liberal margin for this, and remembering that in war-ship requirements the fullest power is only wanted on extreme emergencies, and that nearly all the steaming is done at comparatively small powers, the choice appears to lie in this case between using natural draught only and carrying an increase of sixty per cent. of boilers and their accessories, or using forced draught and carrying, say, fifteen to twenty per cent. more coal than that likely to be used *during the emergency to be provided for.* This would probably be not more that five per cent. of the ordinary coal capacity.

This argument, of course, assumes that the boilers can be forced to the extent named without incurring any risk; but it is perfectly sound for any type of boiler so long as the forcing is kept within safe limits. The ordinary cylindrical boiler has been found to stand a certain amount of forcing, but the troubles with it in some cases, where too much was attempted to be got out of it, has demonstrated that in its case a limit exists beyond which it is risky to go. It is not so well established where the limit lies with the different types of water-tube boilers. Some are

said not to be suitable for forcing at all, while, as an indication of what may be done with impunity with other types, may be mentioned the performances recorded in the transactions of the Institution of Naval Architects for 1894, pages 335 and 336, where it is stated that a Yarrow boiler, when being forced to an abnormal extent, had the fire drawn, the casings taken off so as to cool it as quickly as possible, and then steam again raised in it to 180 lbs. pressure, without sustaining any injury whatever; while a Thornycroft boiler had all the water blown out, the fire partly drawn, and the boiler then pumped up with cold water. It is obvious that ordinary cylindrical boilers would not withstand such treatment, and, of course, no boiler is required to do so; but as failures of boilers when overworked occur through strains caused by some parts being much more heated than others, these very unusual experiments may be looked upon as indicating in some measure that the boilers which withstood them will also withstand severe forcing.

Trials on shore have been made on individual boilers of some of these types, and greater rates of consumption have been obtained with some of them than 70 lbs. of coal per square foot of grate per hour. It need hardly be said that, at least until some coal is discovered containing no ash, such rates cannot be long maintained in actual use.

Whilst treating of the question of forcing boilers, it may not be out of place to make a few remarks upon what are usually termed forced draught, natural draft, induced draught, etc.

It is to be regretted that the word draught has come into general use in connection with furnaces, as it implies something in the way of drawing, whereas the motion of the air is really produced by pressure or pushing; just as in common parlance water is said to follow the bucket of a pump by "suction," whereas, as everyone knows, it is really forced up by atmospheric pressure.

In ordinary "natural," or "chimney" draught, as the chimney gases are heated much above the atmospheric temperatures, they expand until their density is less than that of the atmosphere. The pressure at the top of the chimney, both just within the chimney and just without it, must be equal to that due to the weight of the column of the atmosphere above the chimney. The pressure within the chimney at its base is equal to the pressure at the top of the chimney, plus that due to the weight of the column of hot gases in the chimney, while that without the chimney at the same level is that due to the pressure at the top of the chimney, plus that of a column of air at the ordinary temperature of a height equal to that of the chimney. As this latter is heavier than the column of hot gas, the pressure of the air outside the chimney is greater than the pressure within it, and consequently the air forces itself from where the pressure is greater into the space where it is less. It is seen, therefore, that there is no "drawing" in the case, any more than there is a "suction" with a pump.

If, by other means than height of chimney, a difference of pressure is made between the atmosphere of the stokehold and the gas at the base

of the chimney, a "draught" is created, and the action of the draught in its passage through the fire, tubes, etc., must be exactly the same, if the cause of motion is the same. For instance, if on one day, with a given boiler and accessories, the height of the water barometer is, say, 32 feet = 384 inches, and, by means of a fan working in the uptake, the pressure there is reduced to that due to a water barometer of 380 inches, the stokehold being open to the atmosphere, we shall have a "draught" of 4 inches, pushing the air from the stokehold through the boiler, etc., into the uptake.

If on another occasion the water barometer is 31 feet 8 inches, = 380 inches, and we close the stokehold, leaving the uptake freely open to the air, and then by means of fans we force air into the stokehold, until its pressure is equivalent to a water barometer of 384 inches—that is we obtain a "plenum" of 4 inches, we again get a "draught" of 4 inches, and the conditions are precisely the same as in the first case, except that the first is called "induced," and the second "forced" draught.

It need hardly be pointed out that any amount of "draught" likely to be used with marine boilers must always be much less than the differences in pressure due to a high or low barometer, which might easily amount to 18 or 20 inches of water.

Although there is no difference in the behaviour of gases going through a tube or a structure, whether "induced" or "forced," there are great differences in the methods employed and in the effects on a boiler, and of course there are great differences in the convenience of applying the different plans.

Take, for instance, the case of an open stokehold and forced draught on the closed ash-pit system. Here, if we consider a single fire, we find that all the air must be supplied by the fan; arrangements must be made to admit air under pressure to the fire above the bars. When it is desired to charge the fires the air pressure must be reduced; and it is generally so arranged that only just sufficient is used as will prevent the fire coming out of the door into the stokehold, and this of course prevents the air from the stokehold rushing into the fire. There is, therefore, no rush of cold air into the fire and among the tubes, and the tube ends do not get chilled. By this method also arrangements may be made to supply hot air for combustion, the heat being obtained from the chimney gases on the regenerative system.

On the other hand, with closed stokehold, the air pressure effects combustion when the fire doors are closed, but when they are open there must be an immense inrush of cold air into the fire and amongst the tubes, and this must not only be detrimental to the tube ends and severe on other parts of the boiler, but must also check the ebullition in the boiler. It is obvious also that, with this system, there can be no means of heating the air before admitting it to the fires.

With "induced" draught the same remarks apply with regard to the cold air entering the fire doors, but in this case the whole or a part of the air for combustion may be supplied hot if proper ducts are made for

it and the openings from the stokehold to the ash-pits be either close or restricted.

It will thus be seen that there are some advantages possessed by each system, that of the closed stokehold being the most simple and, in general, the most easily applied to a battery of boilers, and it has the further advantage that when working at low powers, with natural draught, no fans whatever are required, and no air ducts, etc., occupy the spaces in the stokehold.

It is evident that either of the systems may be adapted to water-tube boilers as well as to the ordinary cylindrical type.

In conclusion, the case of the water-tube boiler may be thus summarised.

There are many types of water-tube boilers in use, possessing different features, but in the main the following are the advantages claimed for them :—

1. They may be worked at very much higher pressures than cylindrical boilers; in fact, the limit of pressure which may be employed is more likely to be reached by the engine than by the boiler.

2. They are much lighter than the cylindrical boiler of the same power, both being worked under the same conditions of natural draught.

3. Some types of them at least are capable of much more severe forcing, either continuously or on emergencies, than cylindrical boilers. Under these conditions, therefore, in proportion to their power, they are *very much* lighter and occupy less space than ordinary boilers.

4. They are much more easily repaired or replaced than ordinary boilers.

5. In the event of accident, either through neglect or fracture of steam pipe, boiler tube, etc., from any cause, there will be much less risk either to life or of disablement of the vessel owing to the comparatively small internal capacity of the boiler.

On the other hand—

6. They will be much more troublesome to keep clean; and, in view of the absolute inaccessibility of the interior of some types, after some use, there will always be some doubt as to the condition of the boilers, which can only be resolved by cutting up some of the tubes as samples of the others.

7. There is at present a scarcity of experience of their ecomony of fuel or otherwise. This is, of course, gradually being overcome, and it must be remembered that even if one type should prove to be uneconomical, all others need not necessarily be so also.

8. Being comparatively new, there is not the same experience as to their requirements and with their management. This, however, if they come into use, will gradually be remedied, and, with more experience, better results will be obtained.

Before sitting down, I should like to draw attention to the appendix. I have mentioned in the early part of the paper that some considerable

doubt is felt with regard to the evaporative efficiency of water-tube boilers generally. That doubt has arisen from the bad results obtained in some special cases—one of these being the Lagrafel boiler. I have quoted in the appendix in each case the authority for my figures, and it will be seen on looking at them that the modern boilers, such as the D'Allest, the Anderson and Lyall, the Belleville, and the Niclausse boilers compare very favourably indeed with ordinary cylindrical boilers. There is one difference between some of these trials: some of them have been made on shore, others at sea. I have no doubt whatever that for experimental purposes every care has been taken with all the boilers to obtain the highest possible results. In the case of the trials with cylindrical boilers, these are stated to be under sea-going conditions, but it must be remembered that these trials have all been controlled by a number of experts of the Research Committee of the Institution of Mechanical Engineers, and I do not think it is likely that equal results could be obtained with ordinary working at sea. It will be seen that in one of those cases, that of the "Iona," the cylindrical boiler appears to have a very high evaporative efficiency, quite as high as some of those given by water-tube boilers. In that case I wish to draw special attention to the fact that the boiler was not forced in any possible way. If you look at the comparison of grate area and heating surface you will find that the heating surface in proportion to the grate is abnormally large, and the combustion of fuel is only 22 lbs. per foot of grate, so that really, so far as combustion is concerned, in proportion to heating surface it is very small—much smaller than in any of the other boilers. I think the fact that the boiler was practically only doing about half the average duty will probably account for the high figure in that case.

APPENDIX.

RESULTS OF TRIALS MADE WITH LAGRAFEL-D'ALLEST BOILERS.

Description of boiler.	Duration of trial.	Grate surface.	Heating surface.	Consumption of Cardiff coal per square foot of grate per hour.	Actual evaporation of water per hour from feed temperature per lb. of coal.	Equivalent evaporation from and at 212°.	Remarks.
	hours.	square feet.	square feet.	lbs.	lbs.	lbs.	
Part of installation of vessel of 2,000 I.H.P.	3	Total in vessel 100·75	Total in vessel 4,090	45·75	8·24	9·39	
	3			35·84	9·07	10·34	
	3			15·36	9·43	10·75	
Part of installation of vessel of 9,000 I.H.P.	6	Total in vessel 645	Total in vessel 21,528	20·48	9·80	11·26	These trials were conducted by French Naval Officers.
	12			12·30	10·07	11·53	
	3			24·60	9·50	10·86	
	3			30·72	9·23	10·58	
Experimental boiler	6	35·9	1,076	10·29	10·67	12·44	
Do.	6¾	30·8	1,076	15·15	9·58	11·15	
Do.	6	35·9	1,076	15·50	9·23	10·83	
Do.	6	43·0	1,076	15·36	8·97	10·43	
Do.	3	35·9	1,076	25·09	8·02	9·42	
Do.	3	35·9	1,076	31·00	8·75	10·28	
RESULTS OF TRIALS OF OLDER FORM OF LAGRAFEL BOILER.							
Lagrafel	6	35·9	1,076	15·14	6·72	7·78	Do.
Do.	3	35·9	1,076	15·14	5·43	6·34	
Do.	3	35·9	1,076	20·22	6·53	7·62	
RESULT OF TRIAL WITH ANDERSON AND LYALL'S BOILER.							
	5	8·8	475	18·29	10·0	12·05	This trial was conducted by Mr. Stromeyer, of Lloyd's Register.

The above results are taken from Transactions of I.N.A., 1894.

RESULTS OF TRIALS OF THE NICLAUSSE BOILER.

Description of boiler.	Duration of trial.	Grate surface.	Heating surface.	Consumption of Cardiff coal per square foot of grate per hour.	Actual evaporation of water per hour from feed temperature per lb. of coal.	Equivalent evaporation from and at 212°.	Remarks.
Niclausse boiler	8	19·2	630	18·96	9·25	11·06	These trials were conducted by Messrs. Humphrys, Tennant and Co., to whom I am indebted for the results.
Do.	8	19·2	630	12·94	9·28	11·20	
Do.	4	19·2	630	35·0	7·93	9·59	
Do.	8	19·2	630	29·2	8·27	9·90	
Do.	8	19·2	630	25·31	8·66	10·45	

RESULTS OF TRIALS MADE WITH BELLEVILLE BOILERS ON BOARD SHIP

Under Sea-going Conditions.

Description of boiler.	Duration of trial.	Grate surface.	Heating surface.	Consumption of Cardiff coal per square foot of grate per hour.	Actual evaporation of water per hour from feed temperature per lb. of coal.	Equivalent evaporation from and at 212°.	Remarks.
Four boilers ...	8	135	3842	18·8	8·3	10·24	These results have been communicated by Messrs. Maudslay and Co.
Do.	8	135	3842	19·43	9·1	11·22	
Do.	8	135	3842	19·4	9·0	11·09	
Do.	8	135	3842	24·5	7·83	9·58	
Do.	8	135	3842	12·0	8·5	10·38	
Do.	8	135	3842	12·0	9·16	11·20	
Do.	8	135	3842	9·2	8·64	10·57	

THE FOLLOWING ARE THE MEAN RESULTS OF TWO SERIES OF TRIALS ON DIFFERENT VESSELS FITTED WITH BELLEVILLE BOILERS *under Sea-going Conditions.*

Description of boiler.	Duration of trial.	Grate and heating surface.	Consumption of Cardiff coal per square foot of grate per hour.	Actual evaporation of water per hour from feed temperature per lb. of coal.	Equivalent evaporation from and at 212°.	Remarks.
		Same proportions as above, viz., about 1 to 28·6	12		10·73	These results have been communicated by Messrs. Maudslay and Co.
			20		10·94	
			25		10·33	
			30		9·5	

RESULTS OF TRIALS OF CYLINDRICAL BOILERS FITTED WITH SERVE TUBES, RETARDERS, AND INDUCED HOT-AIR FEED, USING NIXON'S NAVIGATION COAL.

Description of boiler.	Duration of trial.	Grate surface.	Heating surface.	Consumption of Cardiff coal per square foot of grate per hour.	Actual evaporation of water per hour from feed temperature per lb. of coal.	Equivalent evaporation from and at 212°.	Remarks.
Cylindrical Marine type	7 48 7	32	Heatabsorbing surface of tubes 1,306 sq. feet Heating surface of furnaces and chamber, 170 sq. feet Total, 1476 sq. ft. Ratio 1 to 46	33·22 43·79 45·5	9·25 8·91 9·74	10·83 10·5 11·44	These trials were made at Sir J. Brown and Co.'s Works, Sheffield, and the results taken from Trans. Nav. Arch, 1894. They are given here for comparison with those of other boilers.

RESULTS OF TRIALS OF CYLINDRICAL BOILERS ON BOARD SHIP

Under Sea-going Conditions, as recorded in the Reports of the Research Committee of the Institution of Mechanical Engineers.

s.s. "Meteor"...	17	208	5760	19·25	7·46	8·21	Scotch Coal of 12,790 T.U. Calorific value.
s.s. "Fusi Yama"	14	52	2257	18·98	7·96	8·87	West Hartley Coal, 12,760 T.U. Calorific value.
Twin s.s. "Colchester"	11	220	5820	26·1	7·49	8·53	Yorkshire and Nottinghamshire, 13,280 T.U. Calorific value.
s.s. "Iona" ...	16	42	3160	22·4	9·15	10·63	Northumberland Coal, 14,830 T.U. Calorific value.
p.s. "Ville de Douvres"		236	7340	31·3	8·97	9·84	Patent Fuel, 14,390 T.U. Calorific value

Rear-Admiral CLEVELAND: With your permission, Sir, I will offer a few remarks upon Mr. Milton's paper, with the hope that I shall be followed by a very exhaustive discussion. I see here several gentlemen who are perfectly able to give us very valuable information upon this most interesting subject. We are all very much indebted to Mr. Milton for having come here and given us a lecture upon a matter which concerns the Navy to a very great extent, and it is perfectly true that we could never have got these enormous speeds out of the "Torpedo-Destroyers" without the water-tube boiler. That, I think, is pretty well acknowledged. Mr. Milton has brought into line, I might say, the whole of the water-tube boilers which have been in use. He does not profess to describe those in the strictly experimental stage; for instance, yesterday, I had the opportunity of seeing a water-tube boiler which has lately been brought out by Mr. Petersen, who, I see, is here, and who probably will be able to give us some information upon it, and to show that it has advantages greater than those that are possessed by other boilers. It does not possess one essential adjunct which, I think, every water-tube boiler should have, viz., an *automatic* feed; considering the small quantity of water that these boilers contain, and the rapid evaporation, it is an absolute necessity that they should have an automatic feed. I think all of us will be perfectly agreed upon that. The next point, and one which has often struck me, is that in nearly all those water-tube boilers with curved tubes we have no means of ascertaining their internal condition—pitting on erosion—without removing them. We are, therefore, in a fool's paradise until any defect is revealed by some accident. I think something more should be done in the direction of being able to examine the inside of the tubes. I quite agree with what Mr. Milton has said with regard to forced draught in water-tube boilers. It is wiser to carry more coal and use forced draught when you require a high speed (which is rare), than to have a boiler specially designed for high speed with natural draught, and a *constant* high consumption of coal. There is only one more question. It is evident that we are quite in our infancy with regard to these boilers, and it is with some anxiety that one hears that they are to be put into two of our largest cruisers. I have no doubt, however, that the matter has been thoroughly well considered, and that the authorities are perfectly well satisfied that the Belleville boiler is *the* one of the future. I have to thank Mr. Milton for his lecture, and I hope I shall be followed by many others who are more able to speak upon the matter than I am.

Mr. F. E. MACDONALD: The boiler that Mr. Petersen has invented has been constructed by Messrs. John Fraser and Sons at Millwall. We have had experiments going on for the past month to see what the boiler can do, and perhaps with your permission I may be allowed to give a few figures in connection with the experiments which were carried out by Mr. W. H. Thomas, a member of the Institute. We have got evaporation up to 11·25 per 1 lb. of coal from and at 212° F. The advantages of this boiler are that for a very few holes into the steam drum we give a very large number of tubes exposed to the heating gases. This is done by means of a cap which compounds the different tubes into it. Thus with 176 holes in the steam drum we have 1,476 tubes in the flames. Every tube is straight and goes to a direct centre. The steam drum in this boiler which we have made is 9 feet long and the boiler 9 feet high, and the floor space is 8 feet by 9 feet. Expansion is duly provided for, because there are upright pipes which lead from the water chamber into the exact centre, being taken off at distances about a foot apart. The circulation we know is very good, because the steam drum stands on four legs which are hollow, 8 inches in diameter, and whenever the fire is lighted on the grate and the water begins to get hot in the drum we also get a similar heat in the legs and in the water chambers, showing that the circulation is very rapid and very good. In the feed arrangement that we have we take the water through an 8-inch solid drawn Mannesmann steel tube below the steam drum, through the furnace, and lead it then into the centre of the drum at the back. It is then carried by a pipe along the roof of the steam drum, and in

this pipe there are 200 small holes $\frac{3}{16}$ths of an inch, which cause the water to spray down to the water level in the drum through the steam, which at a pressure of 150 lbs. is about 358°. That causes any deposit which is in the water to become granulated and precipitated. We have found when drawing off the water from the water-chambers afterwards that the deposit is of a granulated nature and seems to have no adhesiveness. All the tubes are interchangeable in either row. They can be easily taken out, and there is not a single joint in the fire. It takes twenty-seven minutes to get up steam from cold water. If anything should go wrong with any of the tubes they can be easily taken out by undoing three nuts. That will take out nine tubes. This can be done in three minutes when the boiler is cooled down, and a fresh set of tubes can be put in in about the same time. We do not anticipate getting any scale in this boiler, because the circulation is so rapid. I have often read that with such a rapid circulation as seven or eight miles an hour or more, that it is not likely that there will be any scale in the tubes. Should any scale arise in any of the tubes it may be hammered with a mallet, thereby giving vibration, which would break the scale. The caps can be taken out to do this. I have a set of working drawings here and also copies of the Report, which I should be very pleased to show to members if they would like to see them. I have also here the actual working caps which we have put in.

Captain SANKEY, late R.E.: I wish to congratulate Mr. Milton on his accurate description of the Niclausse boiler, but there is one point upon which, I think, he has been misinformed, namely, with regard to the necessity of using jets of air when working with forced draught. Thus, in the trials made by the French Admiralty on board the "Friant," a mean combustion of 32 lbs. of coal per square foot of grate was obtained from twelve boilers, and one of these boilers was working at 35·98 lbs. of coal per square foot without any injection of air above the plates.[1] The trials referred to by Mr. Milton are those made by Messrs. Humphrys and Tennant. I do not know whether they used air jets in these trials.[2] In connection with the important question of "forcing" water-tube boilers, Mr. Milton compares two trials made with the Niclausse boiler, by Messrs. Humphrys and Tennant, one burning 35 lbs. of coal per square foot of grate area and evaporating 6,454 lbs. of water per hour, and the other burning 18·96 lbs. per square foot and evaporating 4,030 lbs. It will, I think, be of interest to point out that the particular boiler with which these trials were made is rated to evaporate only 1,000 kilogrammes, or about 2,250 lbs. of water per hour. From trials made with the same boiler at Thames Ditton it would appear, however, that its economical evaporation is about 3,000 lbs. per hour, and, I think, therefore, this figure is more strictly the normal evaporation, rather than the figure given by Mr. Milton, namely, 4,030 lbs. It will, of course, be observed that this strengthens Mr. Milton's argument. By this small model of a portion of the Niclausse boiler it will be seen that the inner tube can be unscrewed and taken out, while the outer tube comes out quite readily by simply pressing with a special lever under the projecting ears. The operation of taking out a tube and replacing it can be done very quickly. At Thames Ditton we made trials on this point. On one occasion the boiler was under steam at about 170 lbs. pressure. The water was blown out of the boiler, two or three tubes were taken out and replaced by spare tubes, cold water was then pumped in and the steam pressure raised to 170 lbs. The whole thing was done in 65 minutes. If the boiler is not under steam the operation can, of course, be carried out much more rapidly, inasmuch as a considerable part of the time is taken up in getting the boiler free from steam.

[1] Further particulars of these trials will be found in a paper on the Niclausse boiler, read by Mr. Mark Robinson before the Institution of Naval Architects, at the Paris Meeting, 1895.

[2] I have since communicated with them and find that they used air jets in some of the trials, and thereby obtained a better evaporation.

The mere taking out and replacing of a tube can be done in about ten minutes. I agree with Mr. Milton's remarks as regards scale forming in the tubes. The Niclausse boiler is in a specially satisfactory position in this respect. In the first place, the feed is sprayed into the steam space, as is the case in many other boilers. This arrangement gets rid—as we have found by experience and as has been pointed out by a previous speaker—of by far the greater part of the impurities. A large proportion of what remains of the impurities is found at the bottom of the headers, and it can be drawn off by the blow-off cocks provided for the purpose. The greater portion of the small residue deposits itself upon the inside of the inner tube, where, of course, it can do no harm, and whence it can be removed with great ease. What remains, and it is very little, collects towards the bottom end of the outer tubes, where it will be observed the heat is least, and any such deposit can readily be removed by taking the tubes out—an operation which, as already pointed out, takes very little time. In fact, the ease with which the tubes can be taken out is such that the engineer has the means of knowing at all times in what condition his boiler is, and can keep it always in the best working condition. As regards evaporating at a higher pressure, and reducing down to a lower pressure, Mr. Milton, I think, has an idea that there may be a loss of economy by so doing. As a matter of fact it makes, theoretically, very little difference whether the water is boiled at a higher pressure and reduced by throttling to a lower pressure, or whether it is evaporated at the lower pressure. Theoretically, there is a gain of about 0·2 per cent. Practically, there is a slight loss due to increased radiation and leakage.

Mr. Milton: I should like to ask Captain Sankey one question. Would you be good enough to give us any information as to the difficulty or otherwise of making all these tubes interchangeable, and also tell us what experience you have had with that boiler, as to the durability and tightness of the joints?—because these are the points upon which, I think, success or otherwise depends.

Captain Sankey: With regard to the tightness of the joints that, of course, is one of the most important points. When we first tried this boiler at Thames Ditton, we did not expect a successful result from the experiments which we entered upon somewhat under protest, and we tested the joints by every means we could think of, but in no case did we succeed in making them leak. We therefore came to the conclusion that the joint was excellent. With regard to the manufacture of the joints, there is no doubt a difficulty, but it only requires great care; and as to making them interchangeable, it is only a matter of arrangement in the methods of manufacture and of the use of exceptionally high-class tools—there is no real difficulty in it.

Mr. Milton: I thought, perhaps, you might have had some personal experience with the boiler.

Captain Sankey: We have, as yet, no personal experience in manufacturing the cones, etc., forming the joint. We have not yet started making them.

Mr. Rosenthal (Babcock and Wilcox, Ltd.): There are one or two points in connection with this subject which I should like to refer to. In the beginning of his paper, Mr. Milton mentions that water-tube boilers have not obtained a good reputation for economy in fuel consumption. That statement is scarcely correct, because I think that it is now generally admitted that the water-tube system of boiler, properly constructed, is one of the most economical systems in existence. There are conditions which may make the water-tube boiler uneconomical, just the same as there are conditions under which the ordinary boiler may not be economical; but, comparing both types of boiler, working under similar conditions, the water-tube boiler will certainly be found to be the more economical. That has been proven over and over again by experience of the water-tube boiler for stationary purposes. Of course, so far

as *marine* water-tube boilers are concerned, there are not yet a great number in use in the British merchant service; but, although no elaborate trials have been made, experience has shown—on the ss. "Nero" particularly, during the last two years—that the fuel consumption has been somewhat less than with ordinary boilers working under precisely similar conditions, that is to say, taking the same sized ship carrying the same cargo and running the same time. That, after all, is the best test of the boiler. There is not much room for improvement in economy with the water-tube boiler, compared with the ordinary boiler, fitted on a merchant ship under ordinary natural draught conditions, because in such ships there are conditions which are favourable to the use of the ordinary boiler; that is to say, as the author has pointed out, as much heating surface as is necessary to obtain high efficiency can, ordinarily, be readily installed. Mr. Milton says that, in the majority of merchant vessels, the question of *weight* is of no importance. I happen to know of three instances where this has not been the case, but where the saving in weight was regarded as of considerable importance. One instance was the ss. "Hero" (belonging to Messrs. Thomas Wilson, Sons and Company, Ltd., of Hull), built for fast cargo service, where the amount of cargo the ship was able to carry was increased by 60 tons by the use of the water-tube boiler, the amount which the ship would have carried with ordinary boilers being 1,000 tons. Mr. Milton has referred to the fact that much experience has not yet been had with that type of water-tube boiler which may be called the *straight tube* water-tube boiler, working with *forced* draught on merchant vessels; and as I happen to have received only the other day some particulars of trials carried out by an ex-officer of the United States Navy with one of our marine boilers suitable for merchant service, under forced draught (the boiler having been constructed for experimental purposes), I will give you these particulars. The boiler was one of our type, of practically the same design as that described in Mr. Milton's paper—heating surface, 1,552 square feet; grate area, 38·5 square feet; ratio, 40 : 1. The test was a continuous one, of twenty-four hours' duration, with closed ashpit forced draught, the average air pressure being 1 inch, with ½-inch chimney draught, giving a total draught of 1½ inches. The fuel used was poor grade bituminous, as used at our factory, and known as Pocohontas Run-of-mine, 65% being found by testing samples to be what we term "slack." With this fuel the evaporation exceeded 9½ lbs. per square foot of heating surface per hour, for the whole period of the test. High economy was not expected under these conditions, but the evaporation of 7 lbs. of water per lb. of coal, with cold feed, or 8¾-lbs. from and at 212 deg. Fahr., will appear as an excellent result. The total evaporation per hour was 15,000 lbs., which, at 15 lbs. of steam per I.H.P. per hour, equalled 1,000-I.H.P. The total floor space occupied by the boiler was only 7 feet 6 inches × 8 feet. Mr. Milton mentions another point which I should like to refer to. He states that the water-tube boiler is difficult to clean. Water-tube boilers with *curved* tubes are, of course, uncleanable. But water-tube boilers with *straight* tubes can be cleaned; and there is no doubt whatever that, in ordinary work at sea, the tubes *will* require cleaning, no matter how perfect may be the appliances for preventing sea-water and grease getting into the boilers. With boilers constructed so that the tubes are fixed by an ordinary tube-expander the degree of difficulty is not great. It is true that it is easier to chip scale off the outside of a tube than to scrape scale off the inside, that is, provided you can get at the outside of the tube in an ordinary boiler, which, at any rate, is very difficult; whereas, in the case of the water-tube boiler, you can always get at the inside of every tube. And, assuming in the worst case that there is so much incrustation and salt formed as to render cleaning excessively difficult, it is a very small matter to take a tube out and put another in. In that respect a water-tube boiler which is constructed with tubes which are merely fixed by a tube-expander is very much better than a boiler having tubes which have screwed ends and other such arrangements, for

the latter cost considerably more; so that, as regards cost of upkeep—which is an item to be considered in the use of water-tube boilers on board ship—the type which has plain tubes without any unions or caps, or anything of that kind as part of it, would be very much superior.

Mr. J. I. THORNYCROFT: I hardly like to say much upon this subject, because it seems to me that I am always talking about it; but I think we are greatly indebted to Mr. Milton for his lecture, which has brought this very important subject again before us. He has also brought before us a very good account of all the different boilers with which we are trying to solve a very difficult problem. It has been said that in the merchant service weight is not of importance, but I think that statement requires to be modified, because in the merchant service we now have gradually increased speed, and in passenger vessels the weight of the boiler is becoming really a very important item. It is desirable particularly in passenger vessels, to reduce if possible the weight of the boilers, because by so doing not only can the ships be lightened of their weight, but the propelling machinery and other parts can also be reduced, while the speed and passenger accommodation may be maintained. I think Mr. Milton has thrown undue stress on the difficulty of cleaning water-tube boilers. I take it that the water-tube boiler has now a firm hold, and the problem will be solved by one or other of the many boilers now in use, or some modification of them. What has been said in favour of straight tubes is important, but the great feature of the water-tube boiler is its power to stand forcing, and I think it has undoubtedly been proved that with the exception of these water-tube boilers, in which the tubes are only secured at one end, the straight tubes are at a decided disadvantage as compared with curved tubes. It may be said that any boiler will stand working easily; but the test of the boiler comes when the boiler is hard worked. From the experience my firm has had, attention has been paid to boilers that will stand hard forcing; and we hold that for that purpose it is necessary to use curved tubes. With regard to the difficulty of cleaning, Mr. Milton says that they are always more troublesome to keep clean than ordinary boilers. That is perhaps doubtful, because, as has been mentioned by several speakers, by suitably heating the feed-water in the steam space, or an equivalent to the steam space, the deposit containing the water may be so changed that very little trouble occurs. It may be interesting to know that I have had a boiler at work in a launch on the Thames which has done very hard work in the summer for seven years. The tubes are curved and small, and the boiler is still in good order. Although Thames water is used, which contains a good deal of lime, there is at present no indication that the boiler will break down owing to any internal deposit. The life-boat, the "Duke of Northumberland," which has done a lot of good work, was worked for five years, when it was thought advisable to re-tube the boiler. The tubes were fit for more work, but as the boat went on very dangerous service, and there was only one boiler, and there must be no danger of a break-down, the tubes were replaced. The old tubes were, however, found to be good, and there was no deposit to give any trouble. The boat was not fitted with any distiller, and no doubt a certain amount of water got into the boiler. That perhaps was not a perfectly fair example of a ship at full work at sea, because it was possible that the intervals of rest gave the boiler a chance of cleaning itself.

Mr. JOHN CORRY: In the mercantile marine we have been watching with considerable interest the development of the water-tube boiler in contra-distinction to the cylindrical boiler with which we are all so familiar. Of course, it is a matter of considerable pecuniary interest to us to know the best kind of boiler that can be put into a vessel. I think those who know anything about the present cylindrical boiler will acknowledge that it is at any rate the survival of the fittest. It is a type which has survived all others at the present time, and the constructive details are so thoroughly understood, and the improvements that have been made

in the workmanship, construction of flues, and other details to adapt them to the increased expansion, have been so well met that there is now no serious difficulty in the working. The main point of any new form of boiler is its economy in coal consumption. No doubt some importance is given to the question of the weight of the boiler, but what is of much more importance is the amount of coal used by the boiler, and also the difficulty in keeping the boiler in proper order. A good deal has been said about the facility of repairing these particular types of boilers, but what we want is a boiler that does not require any repairing; we want a boiler which, when once put into a ship, will do its work for years. Knowing the class of workmen we have to deal with, especially firemen, we are very loth to put anything too complex under their charge, because it is quite possible that an incalculable amount of damage may be done. I am satisfied that up to the present we have not very much to fear as regards water-tube boilers. Of course, war vessels, torpedo-catchers, and that class of vessel, have different requirements from the mercantile marine, and what may be imperative in the one may be quite unnecessary in the other. I most heartily thank Mr. Milton for the trouble he has taken in bringing the matter before the Institution.

Mr. JOHN LIST, M.I.C.E.: The few remarks I wish to make are from the same point of view as those of the last speaker, *i.e.*, with reference to merchant steamers. The ordinary cylindrical boiler is on the whole a very satisfactory boiler, but if anything does go wrong in connection with the furnaces it is a difficult boiler to repair. Those who have had the misfortune to find it necessary to replace furnaces will quite endorse what I say upon that point. Fitting them in a mechanical way, *i.e.*, turning and boring the surfaces and putting them in an accurate fit, certainly gets over part of the difficulty, still even with that method of construction the operation of replacing a defective furnace takes about a week. Having had to do such work recently I speak from experience. Such repairs are also very expensive, and unfortunately failures of furnaces are by no means rare. It is a very unsatisfactory thing to find a steel furnace of apparently suitable material crack for a length of several inches in a circumferential direction from the level of the firebars upwards from no reason that one can assign, yet such cracks do occur in comparatively new boilers. Again, it is not at all uncommon to find furnaces changing form and flattening out the sides above the firegrate. I think some engineers who are present will be able to confirm my statement, that it is not an uncommon thing to keep in the repairing works of a steamship company a 100-ton hydraulic jack for putting furnaces which have come down back to the circular form. It is not easy to do that class of work in sites with admittedly imperfect appliances; still it has to be done, and as yet it has not been found possible to avoid entirely such repairs. When I mention these points I merely wish to indicate that although the cylindrical boiler is a satisfactory type on the whole, it has its disadvantages. Also, it is a boiler which certainly will not stand much forcing. I think anyone who has had actual experience will agree with me that, with even a limited degree of forced draught, the boilers very often give trouble. My own very strong belief is, that if we could entirely keep grease out of the boiler there would be very little difficulty. The whole of the trouble, I think, comes from grease; and the man who can perfect a filter which will thoroughly remove grease from the feed-water will confer a lasting benefit on all who have anything to do with marine boilers. As far as I know, there is not a filter at present in use on board ship which is really efficient. No doubt some of the grease is caught on the filtering medium, but still we also find a good deal of it in the boilers; and the conclusion I have arrived at so far is, that a very much greater surface of filter is required than has yet been used. In some cases where filters have been fitted there has been more trouble from grease in the boilers than where no filters were in use. The explanation of this may be, that too much reliance was placed on an appliance which proved inefficient. One thing is perfectly certain, and that is,

that if grease does get into the boiler, and is not promptly removed, the furnaces will very soon give trouble. Speaking of water-tube boilers, I candidly confess that I have had no experience of the care or working of them. I have had the pleasure of making short runs with my friend's, Mr. Thornycroft's, boilers in torpedo-destroyers, and I must say that the performance was wonderful. The speed which those vessels attain is beyond anything which could be done with the locomotive type of boiler, and for that particular purpose, no doubt, these very light water-tube boilers are right. I understand that some of those vessels have made pretty long runs out to foreign stations, and that the boilers have given no trouble. At the Kiel review I saw the "Speedy" making a fine show, and, no doubt, her boilers were all right, or she would not have been there. Referring to the weight of water-tube boilers, I do not know that this point is of so very much importance in the mercantile marine; but certainly the space occupied is of great importance. Only the other day I had occasion to try on paper an arrangement of water-tube boilers for a mail steamer design. I found that, to get the power required, the space occupied was greater than with cylindrical boilers of the usual proportions. There would certainly have been a saving in the weight of water, but not in space occupied. I think that that pretty well follows from the design of the ordinary cylindrical boiler, because there we have three, or it may be four, furnaces at different levels, those at the wings almost overlapping those at the centre of the boiler; whereas in most of the water-tube boilers which are before the public at present the whole of the firegrate area is on one level, and therefore covers more area of the bottom of the ship. No doubt, by forcing the water-tube boiler, and getting a greater I.H.P. per square foot of grate, it may be possible to economise boiler space; but if it comes to be a case of a high rate of combustion, then I must candidly confess I have very little confidence in that for long ocean voyages, for the simple reason that until we get a fuel which is free from ash much higher rates of combustion are impracticable, on account of the difficulty of cleaning fires so frequently and maintaining the firegrates in good condition. I do not think it would be possible to increase our rates of combustion to anything like torpedo-destroyer or even ordinary Navy trial-trip practice, without getting into serious difficulties. A mail or cargo steamer must run for long stretches, sometimes thirty days' continuous steaming, and it is not possible to lay off a boiler for renewal of firegrates. The fact that water-tube boilers can be repaired easily in place on board ship is certainly important; but if it comes to be a case of frequently renewing tubes, then we may possibly be in a worse case than we are at present with defective furnaces. Also, water-tube boilers can, no doubt, be manufactured with less costly plant than heavy shell boilers, and they can be replaced in a ship without lifting the decks, both of which are advantages; but they must also be proved to be absolutely safe, economical in fuel, and not too costly in up-keep, before they can come into extended use at sea. The last speaker has said that we do not want to have any repairs. I am afraid that that is a condition at which we shall never arrive; but if we can have fewer repairs, that would be a distinct gain. I think it is most desirable that the fullest discussion should be given to all designs of water-tube boilers, and more particularly I hope that those who have actually used them on long ocean voyages will give us the benefit of their experience. If those who are using them in the Atlantic trade will come forward and give what information they can, that will be very much to the purpose.

Mr. H. A. B. Cole, M.I.N.A.: We have heard very much about the capacity of water-tube boilers for being forced, and I should like to ask if Mr. Milton knows, as a matter of fact, what the rate of combustion per square foot of grate is in the French Messageries boats, in which these boilers have been working for years. I know very little about it; but it strikes me there is not much forcing there.

Mr. MILTON, in reply, said: I must thank you for the kind reception you have given my paper, and I suppose I ought to feel flattered that there has been no particularly adverse criticism. Admiral Cleveland and Mr. Macdonald asked why I did not refer to the Petersen and Macdonald boiler. I stated that I preferred to deal with those boilers in actual use, and if I had attempted to go into any particular boiler which is at present only in an experimental stage, I should not have known where to stop. I therefore confined myself, with the exception of two boilers, to those which have been in general use. The Lagrafel-D'Allest and the Niclausse boilers, which are in use in the French service, have both given good results. Captain Sankey misapprehended what I wished to imply with regard to the Niclausse boiler. I did not for a moment wish to imply that it was necessary to put in the air-jets to burn 35 or 36 lbs. of coal per square foot of grate: what I wished to convey was, that the use of air-jets effected considerable economy. You could burn, I dare say, a great deal more than 35 lbs. of coal with or without air-jets; but with air-jets there has been a considerable increase in the amount of the water evaporated per lb. of coal burnt. Messrs. Humphrys and Tennant have made experiments with a Niclausse boiler, with jets and without jets, at different rates of combustion. The best results right through the whole series were those with air-jets. Then again, Captain Sankey has misapprehended what I mentioned about the 18 lbs. of coal and the 35 lbs. of coal. I did not imply that the 18 lbs. of coal was the lowest used, or that it was the ordinary natural draught; the assumption was that 35 lbs. was the most. I take that as illustrating not the performance of the Niclausse boiler, but the advantage of using forced draught. I therefore designedly took those results which did not involve too great a difference, in order not to overstate the case. If Captain Sankey were to tell us that the 12 lbs. of coal per square foot of grate was ordinary natural draught, instead of the figures which I gave, ten boilers with forced draught would give the same power as considerably more than sixteen with natural draught. I wished to be clearly within the mark in what I said, and I should not have thought that anyone would have imagined from my paper that 35 lbs. was the utmost that could be obtained with that boiler. All I can say is, that is the utmost which has been burnt by Messrs. Humphrys and Tennant. They have forced the boiler to that extent without any deleterious effects. I think the boiler is not their own property, and they did not do as Captain Sankey tried to do: they did not try to spoil the boiler; they kept within reasonable limits. Mr. Rosenthal and several other gentlemen have spoken with regard to the use of water-tube boilers in the merchant service. I have said in my paper that in the majority of merchant ships—in fact, in all but the large and powerful mail boats (I especially exempted those which Mr. Thornycroft mentioned)—the space occupied by the boilers, and their weights, are not matters of great importance. Mr. Rosenthal, referring to this, mentioned very nearly the same words, but not quite; but managed to convey a different impression. If Messrs. Wilson get an increase of 6 per cent. of cargo capacity through using the water-tube boiler, that would be a mere nothing to them if they obtained it by loss of economy in coal consumption; it would be a mere nothing if they obtained it by increased trouble of keeping the boiler clean. Compared with these questions, a little increase in the weight of the boiler is a matter of no practical importance. Mr. Corry has discussed the question of durability and economy. It goes without saying that people do not build ships for the purpose of spending money in repairs. I was pleased to hear what Mr. List had to say about our old friend the cylindrical boiler. I know, as he knows, that although the cylindrical is a very old servant it is not by any means a perfect one, and I think he might have drawn a very vivid picture, had he liked, of the troubles with the furnaces, and in cleaning the boilers generally; but he has spared us that. Everybody who has had to deal with marine boilers knows that the questions of scale, and grease, and the up-keep, are very serious. If you

have to repair a cylindrical boiler, the time and cost are very serious. It is within the recollection, no doubt, of some gentlemen in this room that some of our friends who have used cylindrical boilers have, in some cases, actually had to put new furnaces into the boilers before they could go to sea for the first time. Mr. Cole has asked a question about the large French mail vessels. They are fitted with the Belleville boiler, working under natural draught. There is no attempt whatever made to force these particular boilers. I do not think there is any other point to reply to; but if any gentleman has any further questions to ask, I should only be too happy to throw any light upon them if I can.

Colonel DAVIS: It only remains for me, as Chairman, to make a few remarks principally to thank Mr. Milton for his very interesting lecture. The position he holds as professional adviser to that great Corporation, Lloyds, and the exceptional opportunities he has of obtaining experience on this matter, renders his paper one of great national value to our Navy and the Mercantile Marine. It would be impossible to have in torpedo-boats the old cylindrical or shell boiler, and it is a matter of paramount importance with the great pressures now in use in the Navy, that the lightest and strongest and quickest steam-making boilers should be used. The increase in the pressure of steam from the old normal pressure of 60 lbs. to 100 and 150 lbs., and now to 300 lbs., made a way for inventors to come forward with a new form of boiler to get rid of a very great engineering difficulty. The old form of shell boiler, with increase of pressure required, of course, increased strength (in thickness) in the plates; and it seems to me that, long before the high pressure of 300 lbs. would be reached, the limit of the thickness of the plates would be reached, and that there would be a great waste of fuel (in addition to many other great disadvantages), in consequence of the thickness of the plates. That difficulty is got over by the water-tube boiler. It appears to me that the future of the water-tube boiler will be a sort of dual contest between the bent tube and the straight tube boiler, both having incontestable advantages of their own. I think Messrs. Thornycroft have done a very great service to this country in their system of bent tube boiler, because with that boiler they have been able to gain most remarkable advantages in forcing speed out of their torpedo-boats. I do not think it is so much a question of durability with the Thornycroft boiler, any more than it is a question of durability in the fire-engine, both requiring exceptionally rapid steam generators, and boilers capable of great and sudden efforts. Messrs. Merryweather brought out a water-tube boiler which had suspended tubes in the centre of the fire-box. I think they called it a "Field" boiler. What we want, it seems to me, in torpedo-boats, is a machine that will undergo the very greatest strain and do the greatest work in a short space of time, and, as I before remarked, durability might even be sacrificed to this end.[1] I think there is a great advantage in the straight tube boiler in that it is one that has, in a larger sense, durability behind it. The only experience I have had of the water-tube boiler, is that of Messrs. Babcock and Wilcox, and I can only say that the working of that boiler quite exceeded my expectations, not only because of its durability, safety, and its many other improved qualities, but because all its parts are made of malleable steel. Malleable iron used in some water-tube boilers may be a very good material, but steel has to be worked, and is therefore tested by being worked up. Mr. Milton has given us a most valuable lecture, which I am sure, when it is published, will do a very great deal of good in instructing people as to what the future of the water-tube boiler in this country is likely to be. I am sure you will all accord a most hearty vote of thanks to Mr. Milton for his very interesting and valuable paper.

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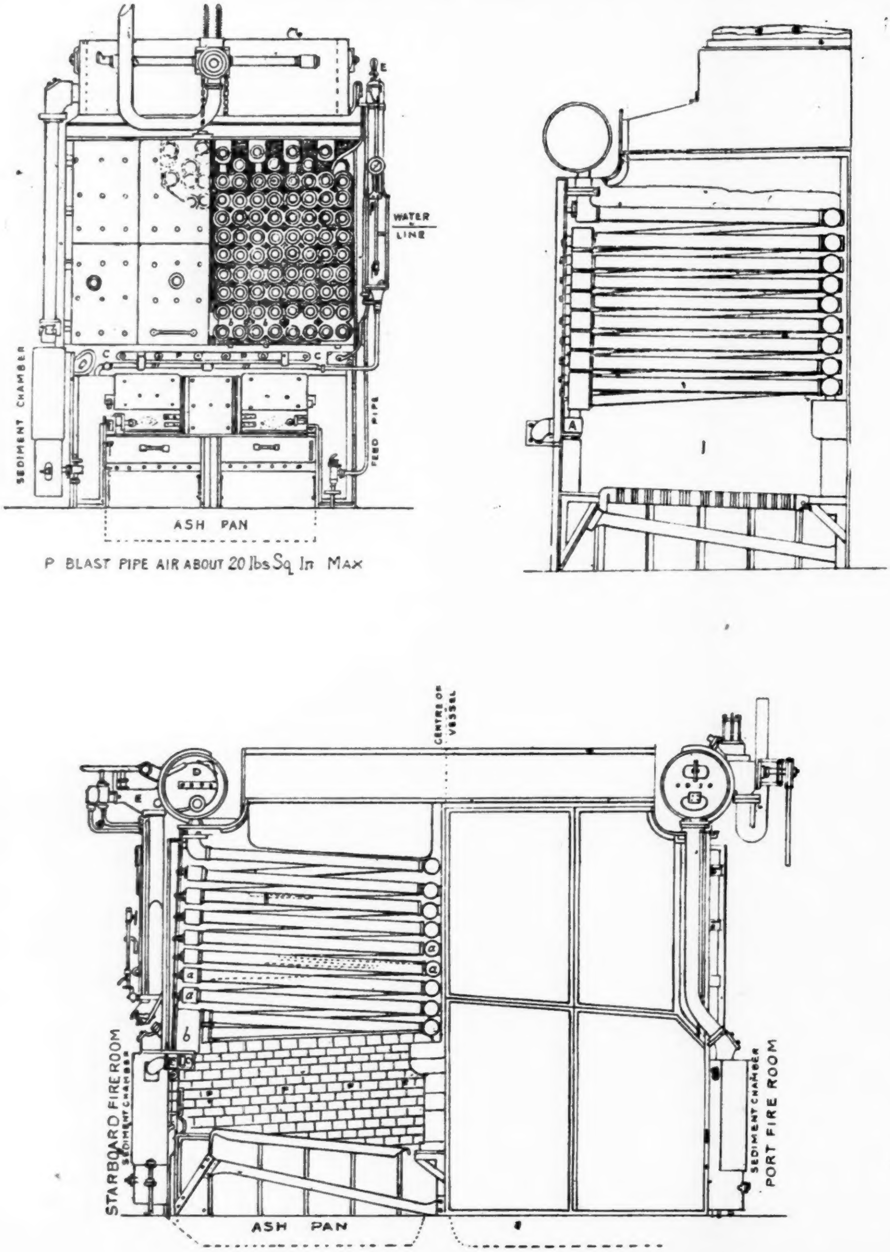
[1] Messrs. Yarrow have obtained magnificent results in their torpedo-boats by their system of water-tube boilers which have straight tubes. —CHAIRMAN.

BELLEVILLE BOILER—Fig. 1.



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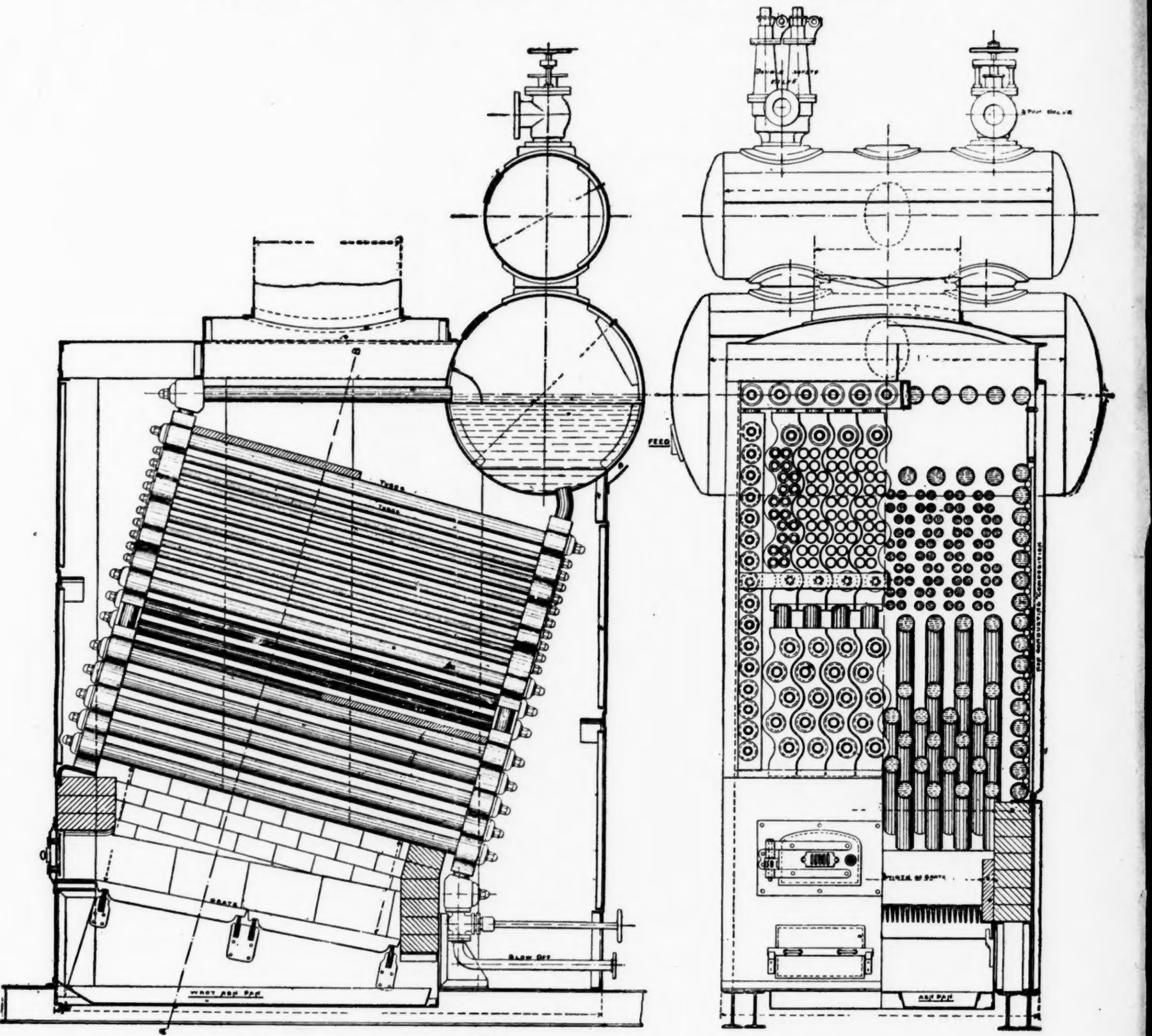
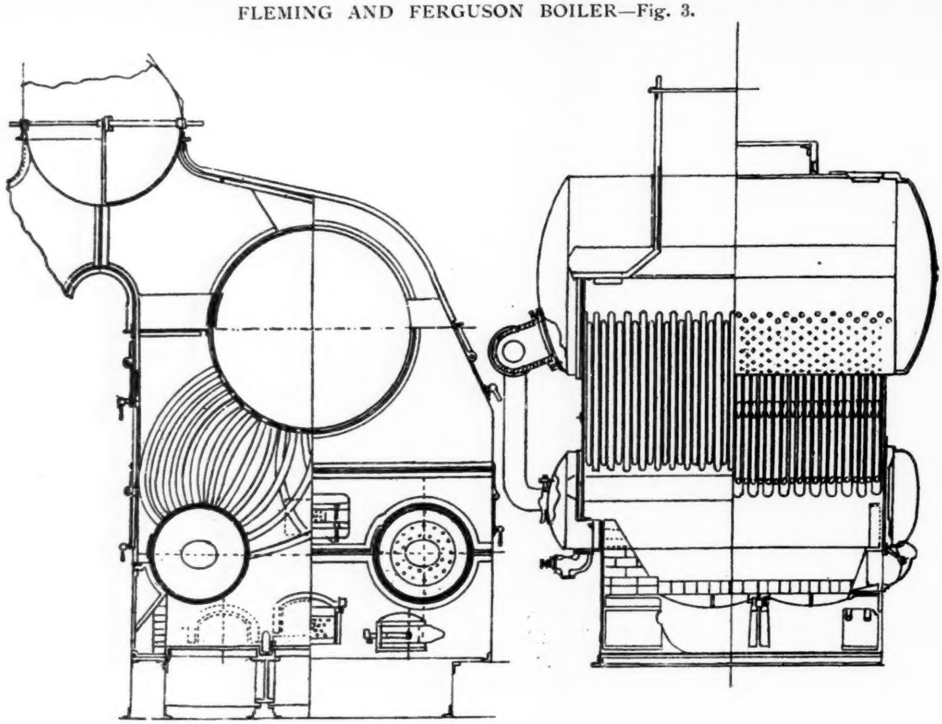
BABCOCK AND WILCOX'S WATER-TUBE SAFETY MARINE BOILER—Fig. 2.



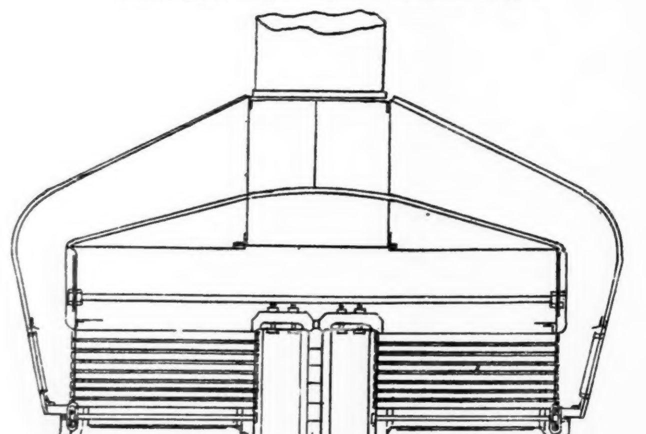
LONGITUDINAL SECTION

FRONT ELEVATION SECTION A B

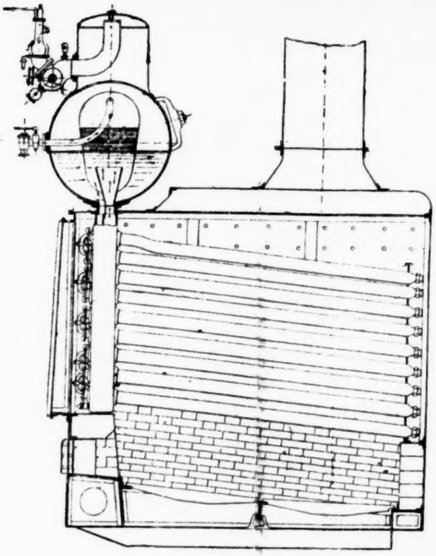
FLEMING AND FERGUSON BOILER—Fig. 3.

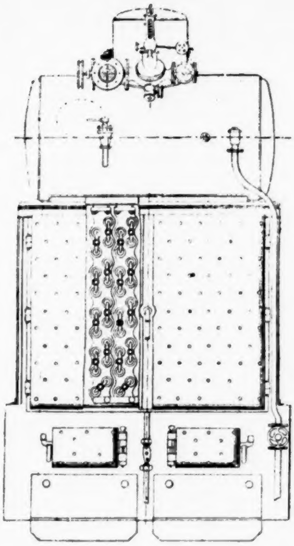


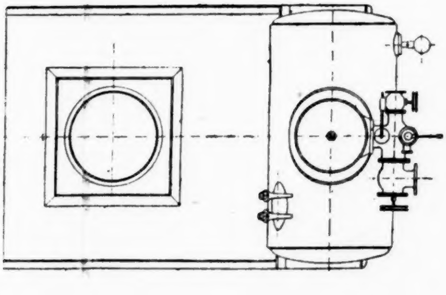
ANDERSON AND LYALL BOILER—Fig. 4.

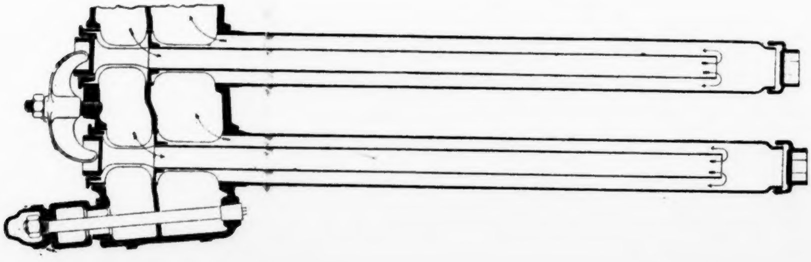


NICLAUSSE BOILER—Fig. 5.

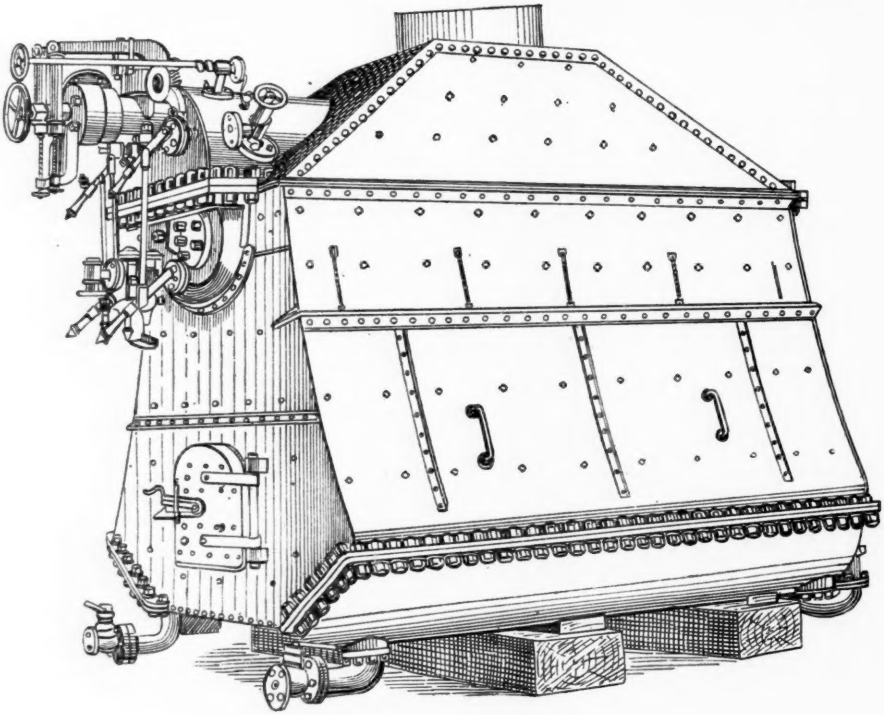




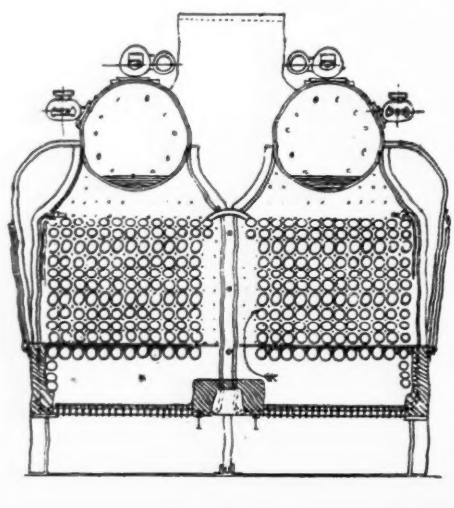


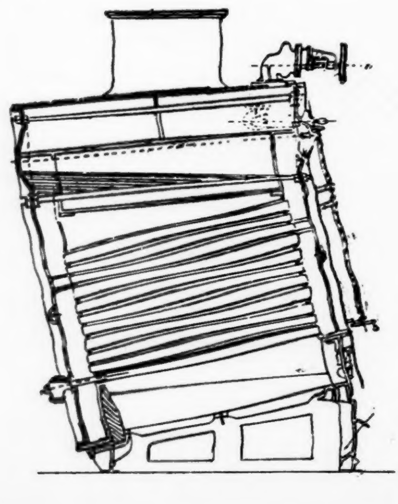


YARROW BOILER



LAGRAFEL-D'ALLEST BOILER—Fig. 6.





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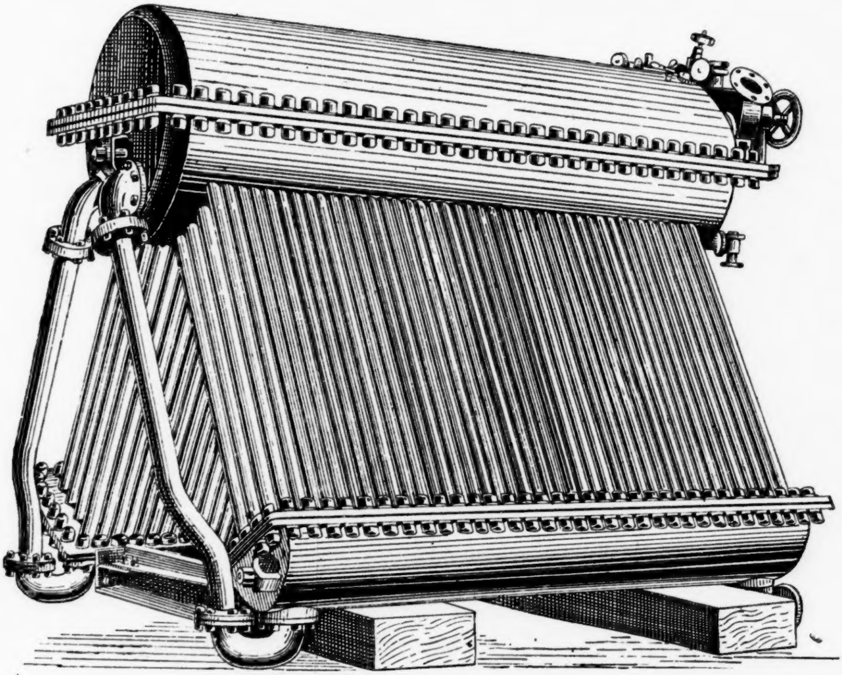
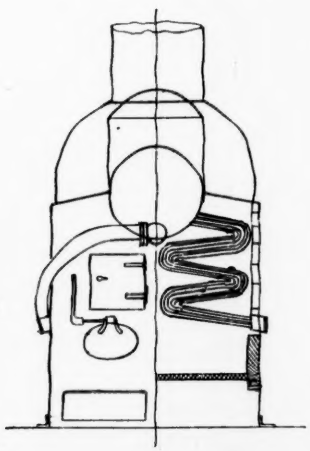
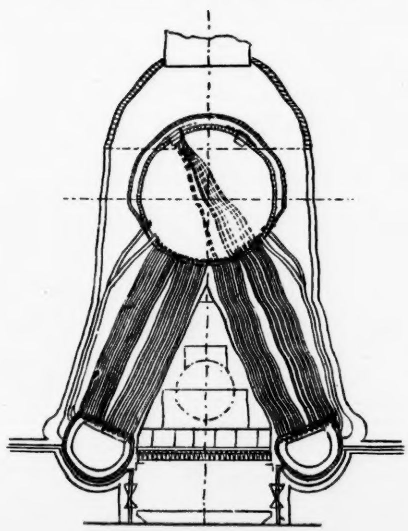
ILER—Fig. 7.

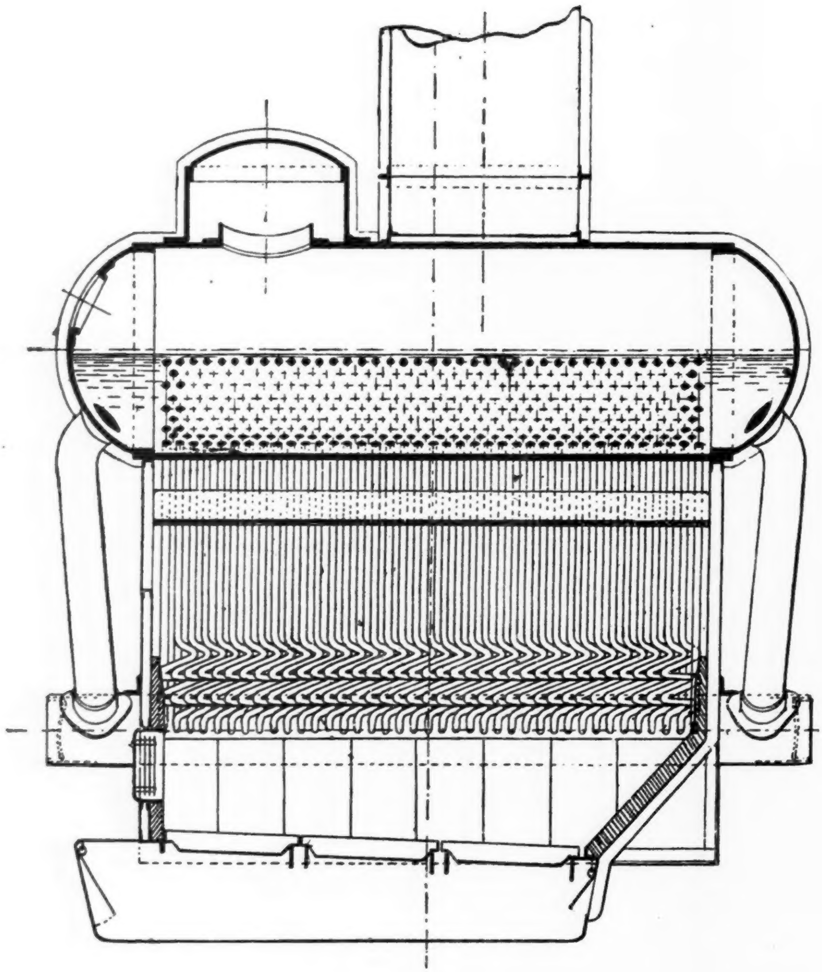


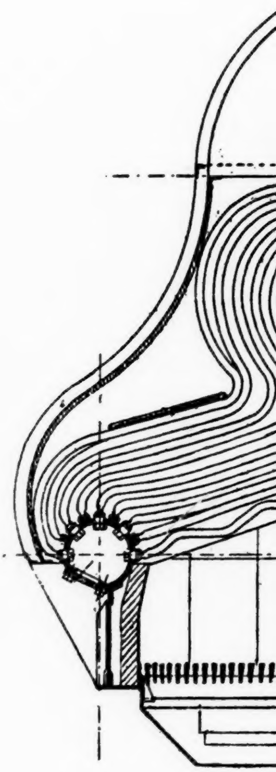
DU TEMPLE BOILER—Fig. 14.



BLECHYNDEN BOILER—Fig. 8.







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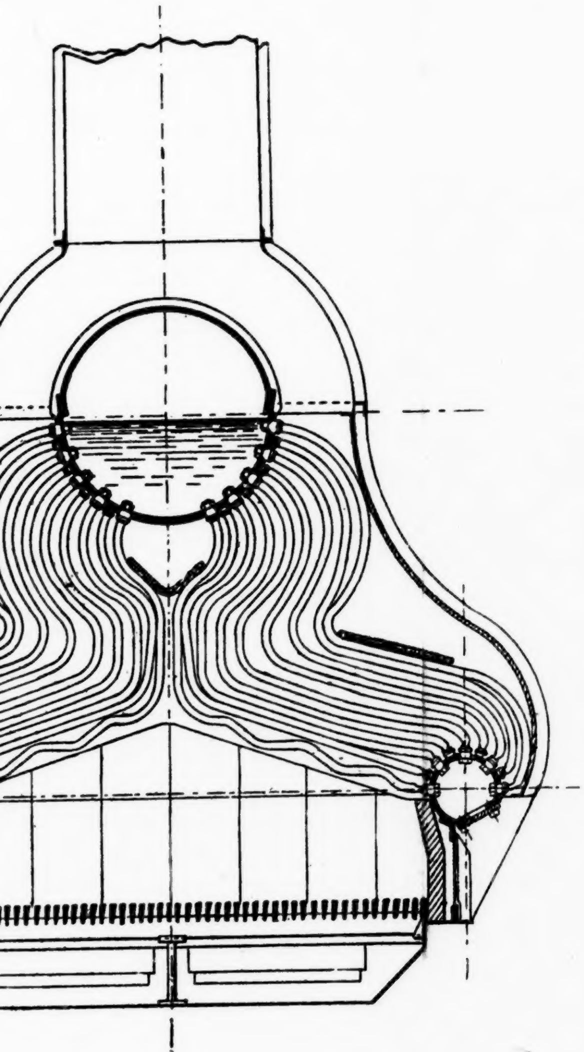
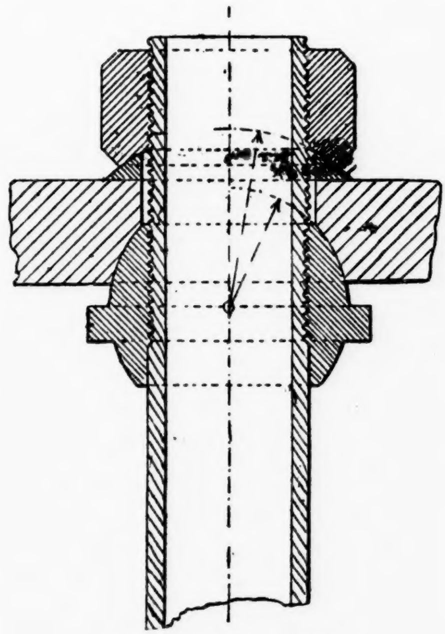
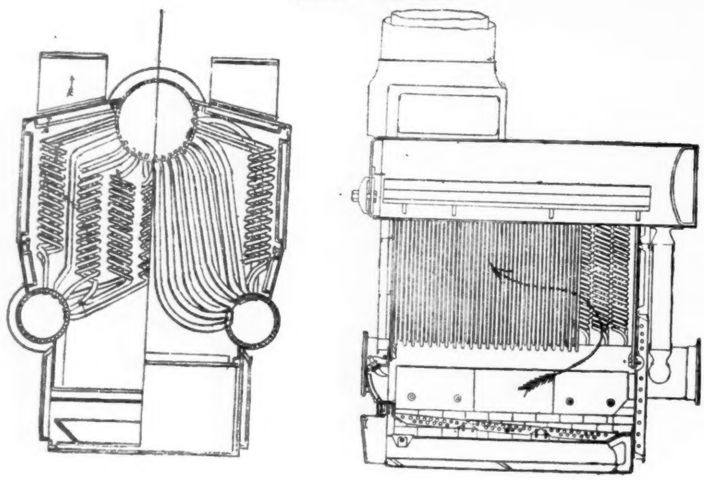
REED BOILER—Fig. 9.



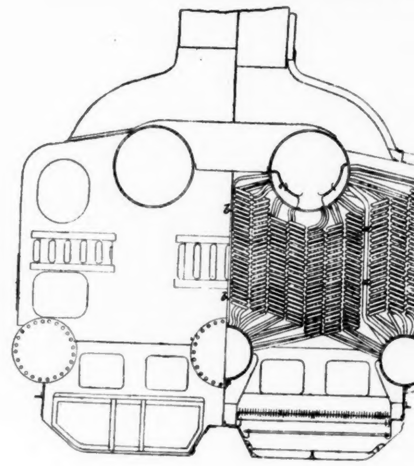


Method of securing Tubes.

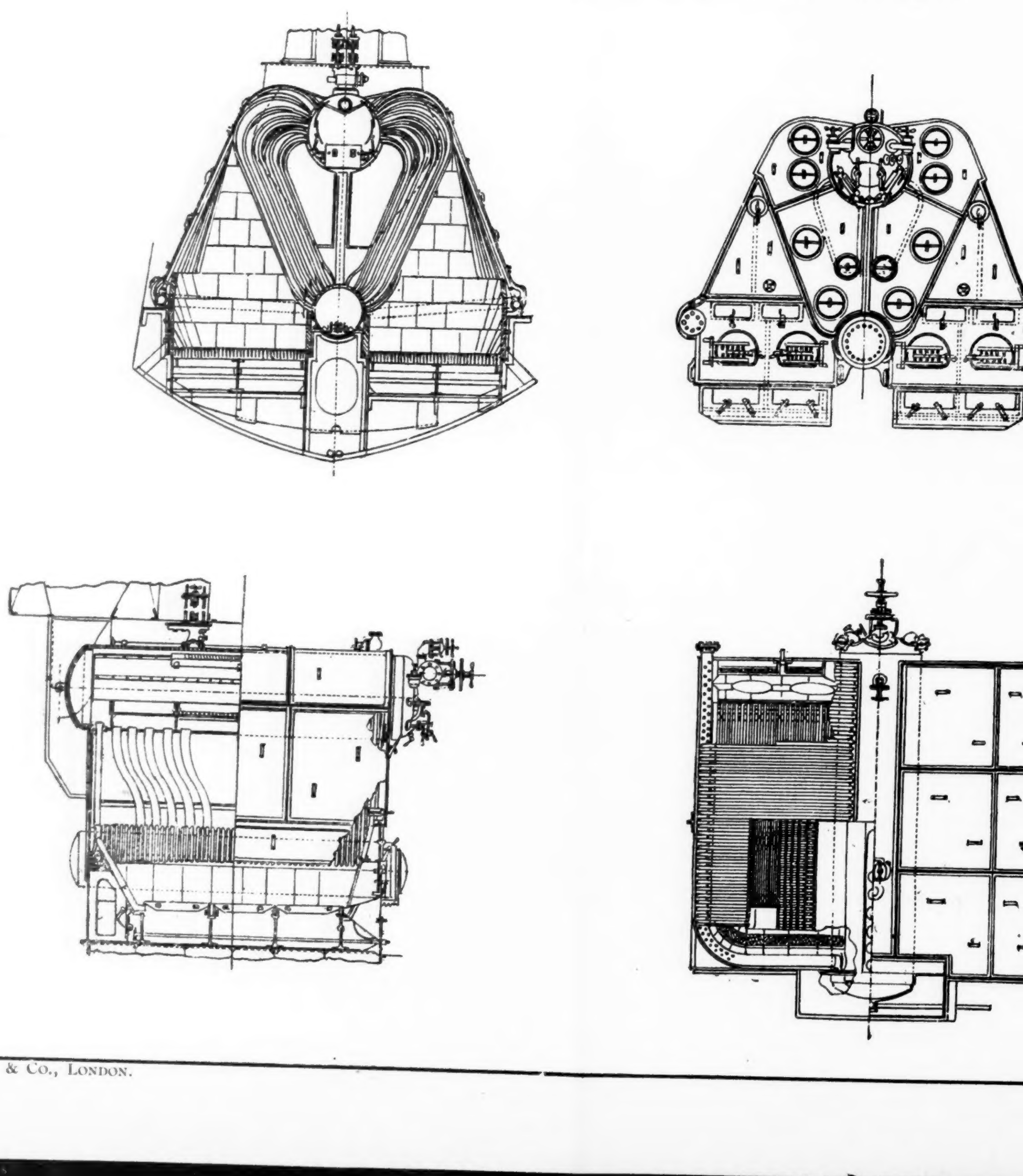
WHITE BOILER.



WHITE'S CO



THORNYCROFT BOILER (Modified) "Daring" Type—Fig. 12.



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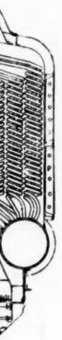
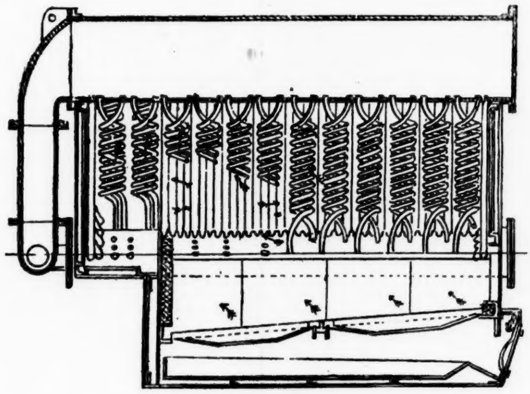
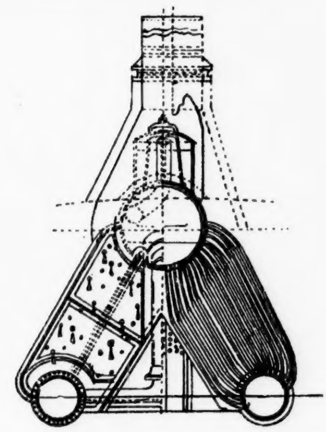
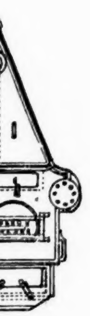
COIL WATER-TUBE BOILER—Fig. 10.



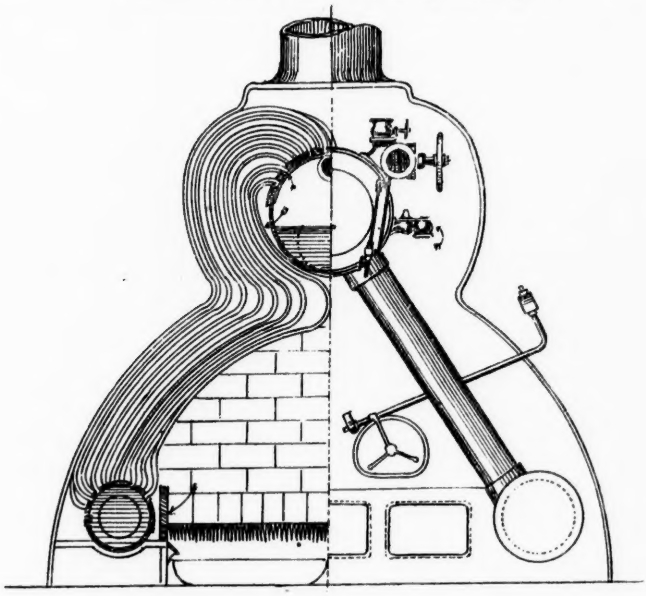


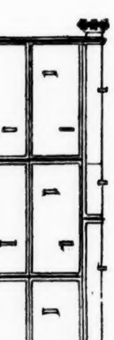
NORMAND BOILER—Fig. 11.

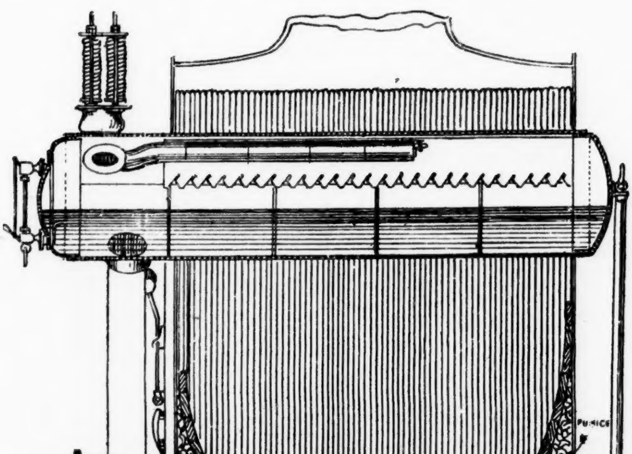




THORNYCROFT BOILER (Original)—Fig. 13.







REGIMENTAL COLOURS IN THE MUSEUM OF THE ROYAL UNITED SERVICE INSTITUTION.

By Major R. HOLDEN, 4th Bn. Worcestershire Regt.

VISITORS to the Banqueting Hall of old Whitehall Palace, since its transformation from an unconsecrated Royal Chapel into the Museum of the Royal United Service Institution, cannot fail to have been impressed with the appearance of the old regimental standards and colours, which, drooping gracefully from the gallery under the canopy of Rubens' unique ceiling, add to the charm and beautiful effect which this historic hall now presents.

Included in this collection of regimental relics are the standards of the 2nd Life Guards and 4th Royal Irish Dragoon Guards, and the guidons of the old 23rd Light Dragoons. Amongst the colours of infantry regiments is one carried by an English regiment during the reign of James II., and sets belonging to the 33rd (Duke of Wellington's) Regiment, the 43rd (Monmouthshire) Light Infantry, the 52nd (Oxfordshire) Light Infantry, the 66th (Berkshire) Regiment, the British-German and British-Swiss Legions, and the South Hants Light Infantry, Royal Merioneth, and Herefordshire Regiments of Militia. Foreign colours are represented by those of seven French regiments, including the 22nd, 26th, 52nd, and 62nd Regiments, with those of the 1st Bn. D'Aveyron, 2nd Bn. des Bouches du Rhône, and the Volunteers of Corsica. China, in which kingdom flags are as common as umbrellas, supplies some dozen of various kinds, of which five may be seen in the hall.

During the time the Institution was housed in the familiar old building in Whitehall Yard these colours were treated with scant courtesy; but since the transfer to new premises they have all, under my personal supervision, been carefully overhauled and repaired with fine silk. This will conduce to their greater preservation, and, it is hoped, add an additional lease to their hitherto somewhat precarious existence. The history of each flag, so far as I have been able to trace it, I have endeavoured to give, in the hope that it may interest readers of this JOURNAL. Some are in a fair state of preservation; but more than one is merely a number of shreds of silk barely held together on a pole worn with age and rough usage in battle. Merely

> " A moth-eaten rag on a worm-eaten pole,
> It does not look likely to stir a man's soul;
> 'Tis the deeds that were done 'neath the moth-eaten rag,
> When the pole was a staff and the rag was a flag."

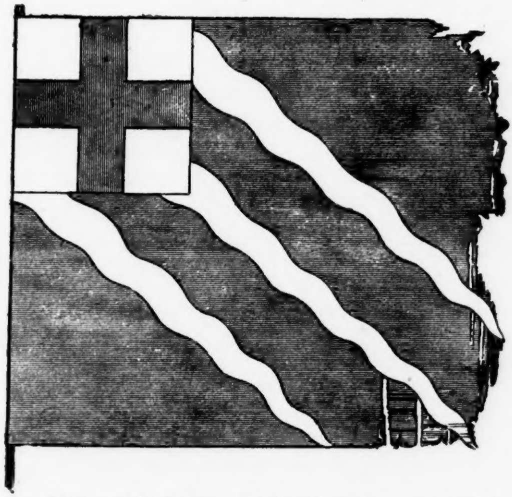
The hastily-executed sketches which accompany this article are but imperfect illustrations of the originals, but they may assist to a better appreciation of them.

Taking English colours first, the most valuable amongst the collection of trophies is that suspended over the northern entrance to the Banqueting Hall, one of the colours said to have been carried by an English infantry regiment during the Monmouth Rebellion of 1685. This flag, which is made of the finest silk—so fine, indeed, that, though nearly 7 feet in length by 6 feet, it can be wrapped in a box 10 inches square—is surrounded with interest. Surrounded with interest, not only on account of the military operations with which we are so familiar in Macaulay's picturesque description of the Monmouth Rebellion, but on account of its rarity, as being one of the first colours carried by the Standing Army of England.

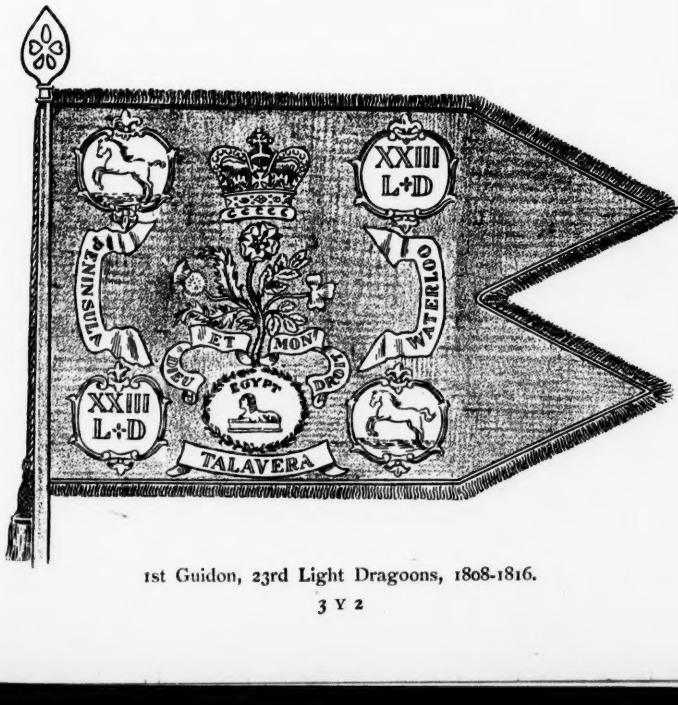
At the Restoration, in 1660, from which period the Standing Army may be said to date, each company of an infantry regiment carried a colour, the regulations with regard to them being almost identical with those which prevailed during the civil war between Charles I. and the Parliament, and which obtained in the Army until the reign of William III. A similarity was observable throughout all the colours of a regiment, with some slight distinctive difference for each company, so that not only each regiment, but each company on parade, could be distinguished at a glance.

The colours of a regiment would be white, blue, yellow, or green, according to its clothing or facings; but those of all companies in one regiment would have the same shade of colour. The Colonel, the Lieut.-Colonel, and frequently the Major, commanded companies, and the Commanding Officer's flag was usually plain throughout. The Lieut.-Colonel's was the same, with the addition of a canton in the upper corner near the spear-head, bearing the Cross of St. George on a white field; and the Major's would be similar to that of the Lieut.-Colonel, with the addition of some heraldic device, such as a mullet, a trefoil, or pile. The senior Captain's colour would have two of these heraldic devices, the second Captain's three, and so on. In the regiment to which this particular colour belonged the flags throughout each company would have been blue. From the appearance of the St. George's Cross in the upper canton, and the three white flames, or piles wavy, it was evidently the colour carried in the second Captain's company.

It has been religiously preserved in the same family for over 200 years, and descended through the female side to the present owner, Mr. Harry F. Shorland. According to a family tradition, it was carried by a regiment on the side of Monmouth, the misguided Protestant champion ; but the best authorities on colours incline to the belief that it was borne by a Line or Militia regiment on the Government side, the design being strictly according to regulation. However this may have been, the flag is equally interesting, and to Mr. Shorland a debt of thanks is due for



Second Captain's Colour. Regiment of Foot, *circa* 1680.



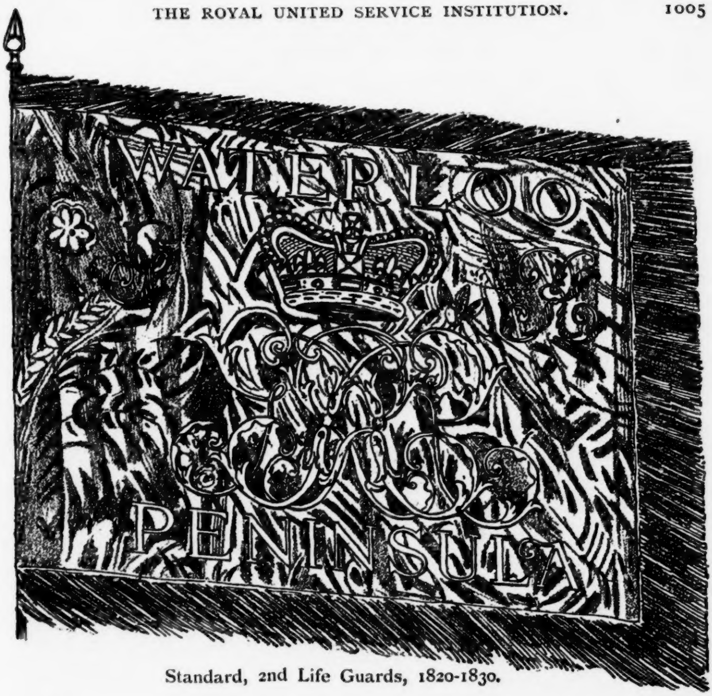
1st Guidon, 23rd Light Dragoons, 1808-1816.

his patriotism in parting with a family heirloom of much historic value, in order to admit members of the Institution and the British public to a share in the interest experienced in its inspection. Though it has been deposited with the Institution for a definite period, it is hoped that it may eventually find a permanent resting place alongside the other colours, which now rest peacefully in a building of unequalled historic interest and associations.

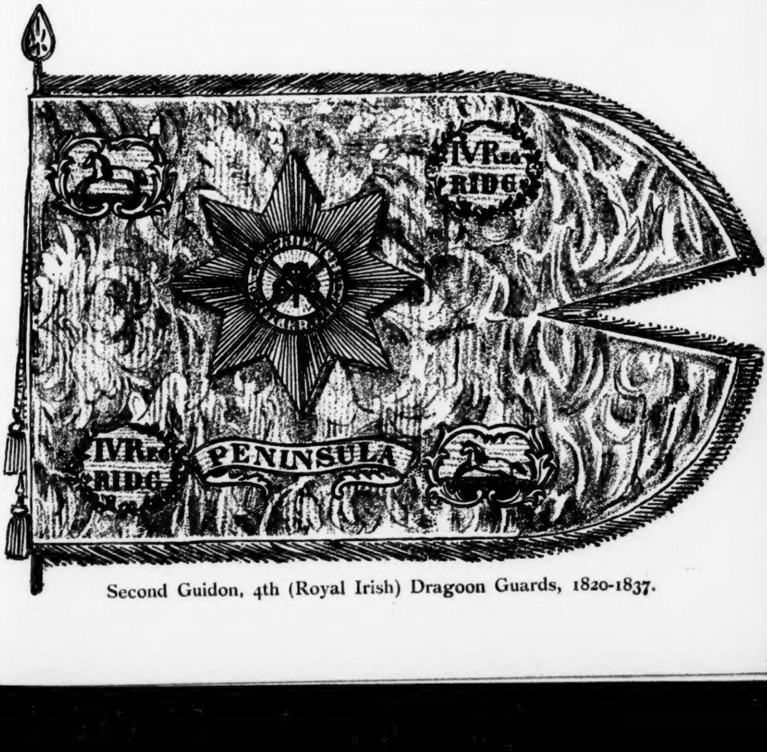
Next in point of interest come five guidons, hanging on the naval side of the hall, nearest the southern entrance, which were carried by the old 23rd Light Dragoons,[1] and which are believed to have led the regiment in its celebrated charge at Talavera in 1809.[2] The regiment was in Anson's brigade, which was ordered by Sir Arthur Wellesley to attack Villatte's division. Napier tells us that the 23rd, with the 1st German Hussars, starting at a canter and increasing their speed as they advanced, rode headlong against the enemy, but in a few moments came upon the brink of a hollow cleft, which was not perceptible at a distance. The French, throwing themselves into squares, opened their fire; and Arentschild, commanding the German Hussars, an officer whom forty years' experience had made a master in his art, promptly reined up at the brink, exclaiming, in his broken phrase, "I vill not kill my young mens!" But in front of the 23rd the chasm was more practicable, the English blood hot, and the regiment plunged down without a check; men and horses rolling over each other in dreadful confusion. The survivors, still untamed, mounted the opposite bank by twos and threes, and Colonel Seymour, being severely wounded, Major Frederick Ponsonby, a hardy soldier, rallied all who came up, and passing through the midst of Villatte's columns, which poured in a fire from each side, fell with inexpressible violence upon a brigade of French chasseurs in the rear. The combat was fierce, but short; Victor had perceived the first advance of the English, and detached his Polish lancers and Westphalian light horse to the support of Villatte; and these fresh troops coming up when the 23rd, already overmatched, could scarcely hold up against the chasseurs, entirely broke them. Those who were not killed or taken made for Bassecur's Spanish division, and so escaped, leaving behind two hundred and seven men and officers, or about half the number that went into action. The facings of the regiment being crimson, the first guidon was, as usual, of that hue. For distinction's sake, though hardly in accordance with the regulations, the other guidons were blue. It is impossible to decide with exact certainty the date when they were made, but probably soon after the regiment was renumbered in 1803; the battle honours "Peninsula," "Talavera," were added

[1] The regiment raised in 1795 as the 26th Light Dragoons was renumbered the 23rd in 1803, converted into lancers in 1816, and disbanded in 1817. The uniform was blue, with crimson facings and gold lace. It served in the West Indies, in Egypt, in the Peninsula, and at Waterloo.

[2] They were presented to the Royal United Service Institution on 20th August, 1872, by Major F. Bolton.



Standard, 2nd Life Guards, 1820-1830.



Second Guidon, 4th (Royal Irish) Dragoon Guards, 1820-1837.

in 1815 or 1816, where space could be found for them. On the conversion of the regiment into lancers, in 1816, the standards were discarded.

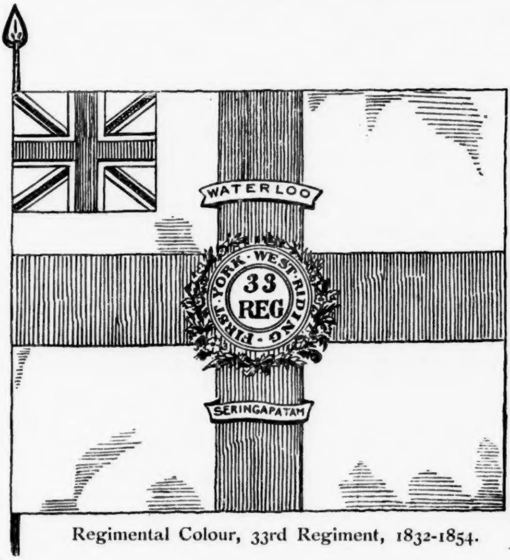
At either end of the military side of the Museum hang the standards of the Second Life Guards, carried during the ten years of George IV.'s reign.[1] They are made of crimson damask, fringed and embroidered with gold. They have never been on active service, and are associated rather with ceremonies of State. They did duty at the coronation of the King when the regiment appeared for the first time in bearskin grenadier caps. They accompanied the regiment at the funeral of H.R.H. the Duke of York, Commander-in-Chief of the British Army, and at the funeral of George IV. They were again displayed at the accession of William IV., the founder of this Institution.

At the northern entrance to the Museum on the east side are to be seen two standards of the 4th (Royal Irish) Dragoon Guards,[2] in use during the reign of George IV. and William IV. The first, or King's standard, is of crimson damask, of the guidon shape, and edged all round with gold and crimson fringe. In the centre is the Union badge of the rose, thistle, and shamrock on one stalk; underneath is the word "Peninsula" in a scroll; and in each of the four corners, in blue silk, an oval badge, as shown in the illustration of the second standard. The second standard is of blue damask, fringed with gold, and the small ovals at the corners on red silk. In the centre is the Star of St. Patrick. These standards have seen no service more actual than the suppression of riots in England and Ireland; but like those of the 2nd Life Guards they recall many State ceremonies and escorts. They are associated, in this manner, with Queen Adelaide, William IV., Don Miguel of Portugal, and the Queen of Portugal. They were taken into use about the time when the regiment was reduced to six troops. Previous to this the troops were classified according to the colour of the horses, there being two black troops, two brown troops, two bay, one bright bay, and one chestnut.

The first colours drooping from the north end of the gallery, on the western or military side, are those of the 33rd Duke of Wellington's Regiment—then known as the 1st Yorkshire (West Riding)—which were presented to the battalion, in 1832, at Weedon, by General Sir Charles Wale, K.C.B., colonel of the regiment. The first is the ordinary Royal colour, or Great Union; and the second, or regimental colour, the Red Cross of St. George on a white field, and only two honours are attached, those of "Peninsula" and "Seringapatam." They have never been on

[1] They were presented to the R.U.S.I. on 14th May, 1849, by Colonel (afterwards General) St. John A. Clerke, K.H., Colonel of the 75th Regiment, who died in 1870.

[2] Presented to the R.U.S.I. on 6th June, 1858, by Colonel (afterwards General) Sir Edward Cooper Hodge, G.C.B. He commanded the 4th Dragoon Guards throughout the Crimean Campaign, and died Colonel of the Regiment in 1894.



Regimental Colour, 33rd Regiment, 1832-1854.

Royal Colour, 43rd Light Infantry, 1818-1827.

active service, but they are associated with two interesting military events. From 1838 to 1840 the 33rd were at Gibraltar, and there under these colours H.R.H. the Commander-in-Chief, then Prince George of Cambridge, was attached for duty to the battalion on his first introduction to the British Army. The 33rd, as is well known, monopolised most of the regimental service of the great Duke of Wellington, and at his funeral on 18th November, 1852—to attend which the regiment was brought to London from Glasgow—these colours proved a conspicuous mark. A curious story is told in connection with them. The colours were lodged in the town house of the commanding officer, Lieut.-Colonel F. R. Blake, at 62 (now 25), Portland Place, where the colour party were billeted. To the simple, uninitiated mind of Mrs. Blake the ragged condition of the regimental colour seemed a reflection on the regiment which she was bound to remedy. To effect this, her white silk wedding dress was brought into requisition, and the repairs can be plainly seen to this day. The colours were retired from service at Dublin in 1854, prior to the 33rd proceeding to the Crimea; were deposited at Danesbury, Welwyn, in Hertfordshire, with the commanding officer; and were presented by his widow to the Royal United Service Institution on 13th April, 1861.

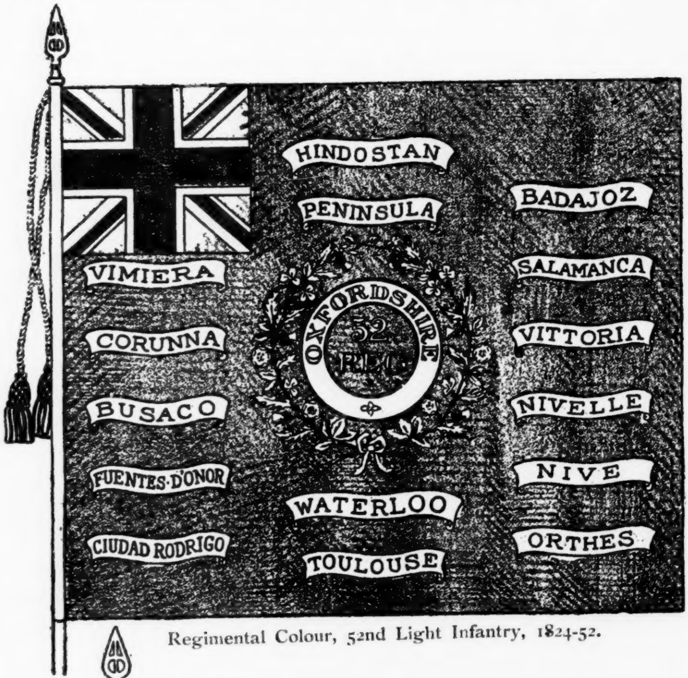
The next set of colours on the western side of the hall belonged to the 43rd Monmouthshire Light Infantry, one of the regiments of the celebrated Light Division of Peninsula fame. The 1st, or Royal colour, is the Great Union; and the second, or regimental colour, the Red Cross of St. George on a white field. They only bear the one distinction "Peninsula," the other honours shortly afterwards authorised not having been added. They were made to replace those carried with such distinguished honour in the Peninsula, and were presented to the regiment in 1818 at Valenciennes by Lady Blakeney, wife of Colonel Sir Edward Blakeney, K.C.B., commanding the 7th Fusiliers, which, with the 23rd Fusiliers and 43rd Light Infantry, formed Major-General Sir James Kempt's brigade of the Army of Occupation in France. Lieut.-Colonel C. C. Patrickson, C.B., commanded the 43rd, with Lieut.-Colonel W. F. Napier, C.B., the historian of the Peninsular War, for his major. The colours were carried on parade at the celebrated review held on 23rd October, 1818, the day before the break up of the army, when the whole of the British, Hanoverian, Saxon, and Danish contingents commanded by the Duke of Wellington were paraded before the Emperor of Russia and King of Prussia near Valenciennes. They were again on parade when the 43rd were inspected at Gibraltar, in 1822, by General Foissac le Tour, commanding the French army in Spain: the occasion when he was forced to admit that the regiment moved quicker than the French infantry, whom he had hitherto prided himself were the fastest in Europe. Their last public act was to accompany the regiment to the Peninsula in 1827, when 5,000 British troops were despatched under General Sir Henry Clinton, owing to the disturbed state of Portugal and the hostile attitude of Spain. The expedition was remarkable for nothing

beyond the strange contrast it formed to the stirring incidents which had marked the footsteps of the 43rd over much of the same ground in 1810 and 1811. A few months later the colours were retired from service, when a new set bearing the eleven additional honours authorised in 1821 were presented by Mrs. Haverfield, wife of the commanding officer, Lieut.-Colonel William Haverfield. On the death of Colonel Haverfield in 1830, the old colours came into the possession of Lieut.-Colonel Henry Booth, K.H., who died in 1841, and whose son last year restored them to the regiment. On 8th April, 1895, they were presented to the Royal United Service Institution by Colonel J. Johnstone and the officers of the 43rd (now the 1st Bn. Oxfordshire Light Infantry), to be placed alongside those of the sister-battalion, the 52nd Light Infantry.

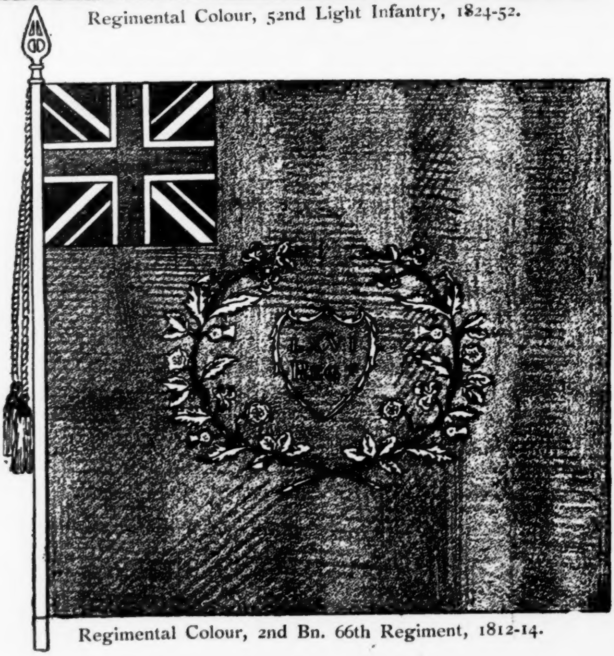
The third pair of colours on the western side of the hall belonged to a famous regiment, the 52nd Light Infantry, now the 2nd Battalion of the Oxfordshire Light Infantry, and they appropriately hang next those of their linked battalion and old Peninsular comrades, the 43rd. The Royal, or King's colour, is the Great Union, and is so dilapidated that it can scarcely hold the honours attached to it. The regimental colour, which is in much better condition, is of buff silk, and bears the thirteen honours shown in the accompanying illustration.

They were presented to the regiment at St. John's, New Brunswick, in 1824, to replace the colours which the 52nd had so nobly borne in the Peninsula and Waterloo. In that great struggle, the 52nd were commanded by the celebrated Lieut.-Colonel John Colborne, afterwards Lord Seaton, he whom Napier justly described as "a man of singular talents for war, and capable of turning the fate of a battle." This distinguished soldier, who had so often led the regiment to victory, and never hurried it into defeat, commanded the 52nd when these colours were taken into use in 1824. They have never faced a foreign foe, but they were silent witnesses of the steady discipline and bravery of the regiment on board the transport "Marquis of Huntly," which was nearly lost in a hurricane in the Atlantic in 1831. It is a coincidence that these colours and those of the 43rd, lying alongside, faced each other on parade when the two regiments relieved each other at the Beggar's Bush Barracks, in Dublin, on 1st February, 1833. They accompanied the 52nd at home and abroad for nearly twenty-eight years, and were borne on parade for the last time at Dublin on Her Majesty's birthday in 1852, when the regiment received a new set from their Lieut.-Colonel, Cecil William Forester. When Siborne's celebrated model of Waterloo was shortly afterwards placed in the Royal United Service Institution, Lieut.-Colonel Forester and the officers of the regiment presented the old colours to be placed near it, and they were crossed over the large bust of the Duke of Wellington.

The last pair of colours on the western side of the hall are those of the 66th, or Berkshire Regiment, which have a peculiar history attached to them. The 2nd Battalion of this regiment, with the 2nd Battalion



Regimental Colour, 52nd Light Infantry, 1824-52.



Regimental Colour, 2nd Bn. 66th Regiment, 1812-14.

48th, the Buffs, and 31st, were in Colborne's Brigade at Albuera, which was nearly destroyed. The loss of the four battalions amounted to 1,413, of which the 66th reached 272; and so weak had they become that it was found necessary to form them into Provisional Battalions, when the 66th and the 31st were formed into a battalion commanded by Colonel Leith, of the 31st. It was necessary to supply the 66th with new colours after the battle. They duly arrived early in 1812, but were not taken into use because the colours of the 31st, as the senior regiment, were carried by the Provisional Battalion. They were, therefore, sent home, and when the regiment arrived in England in the summer of 1814, were sent to Plymouth to meet the battalion. But they were lost, never reached their destination, and it was necessary to make another set[1] for the battalion. Not long afterwards they turned up again, but too late to be taken into use. They came into the possession of the commanding officer, and were presented to the Royal United Service Institution on 8th March, 1876, by Miss L. Nicholls, a relative.

The eight colours suspended from the gallery on the eastern side of the hall, and which were deposited in the Institution by the authorities of the Tower of London, are rather a miscellaneous collection. They are very handsome in appearance, but have not the same interest attached to them as those already described. Four of them were carried by regiments which no longer find a place in the British Army—the British-Foreign Legions called into existence by the exigencies of the Crimean War. They were raised partly in England and partly abroad in 1855, and were disbanded two years later. The British-German Legion is represented by the Royal or Queen's colour of the 4th Light Infantry Battalion, and the regimental colour of the 6th Light Infantry Battalion. The other two are the regimental colours of the 1st and 2nd Light Infantry Battalions of the British-Swiss Legion. The regimental colours of these legions are very handsome, and consist of a red cross on a black ground, with the union in the upper canton.

Of the remaining four colours found on the same side of the hall, one is the King's colour of a regiment having no name or number on it; the others are the regimental colours of the Royal Merioneth Light Infantry Militia (now the 4th Battalion Royal Welsh Fusiliers), the South Hants Light Infantry Militia (now the 3rd Battalion Hampshire Regiment), and the Herefordshire Militia (now the 4th Battalion Shropshire Light Infantry). That of the Merionethshire is blue, the South Hants is yellow, and the Herefordshire is a faded apple or gosling green. They are all three interesting to the extent that they represent the very creditable services, so soon forgotten by the British public, which the embodied Militia rendered to the country prior to the Crimean War.

[1] This set, which were taken into use in 1815, and bore the distinction of Peninsula," were carried until 1817, when on the amalgamation of the two battalions at St. Helena they were discarded. They are now in the possession of the 2nd Battalion Royal Berkshire Regiment.

We now come to what some consider the most interesting portion of the collection, the foreign flags captured in active service. Suspended from the lower windows on the western side of the hall are the tattered remains of five colours taken from our brave enemies, the French, during the early part of that long struggle which commenced in 1793 and was not finally terminated until 1815. They were presented to the Royal United Service Institution by the late Lieut.-General Sir Henry E. Bunbury, Bart., K.C.B., and belonged to the 2nd Battalion of the 26^e Régiment d'Infanterie, the 1st Battalion of the 52^e Régiment d'Infanterie, the 1st Battalion of the Département de l'Aveyron, the 2nd Battalion of the Département des Bouches du Rhône, and Les Volontaires du Département de la Corse.

The flag of the 26^e Régiment[1], which is the same both sides, is white, with the letters and numerals in gold. The wreath surrounding the number is green. At either end of the cross are tricolour lozenges of blue, white, and red, which by a decree of 28th November, 1792, were ordered to be placed over the fleurs de lys, which had, before that, adorned the colours of the French army.

That of the 52^e Régiment is white, but with a tricolour of blue, white, and red, in the upper canton, showing that it belonged to the 1st Battalion. It has also a tricolour border of blue, white, and red on either of the three edges. Otherwise it resembles the flag of the 26^e Régiment.

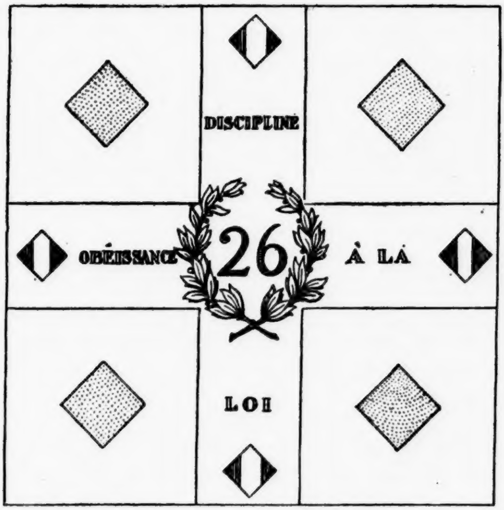
The colour of the 1er Bataillon du Département de l'Aveyron, is a tricolour of blue, white, and red, with a white stripe across the centre, and is 5 feet 9 inches square. On the one side are the words "Subordination, Obéissance à la Loi," and on the reverse "1er Bataillon Daveron République Française" in gold.

The flag of the 2^e Bataillon du Département des Bouches du Rhône, is an ordinary tricolour of red, white, and blue, and is 7 feet deep on the pole. It has a border of alternate blue, white, and red. On the one side, in gold, are the words "Département des Bouches," "2^{me} B^{on}," and on the reverse "Égalité," "Liberté," "2^{me} B^{on}."

The flag of Les Volontaires du Département de la Corse, is also a tricolour of blue, white, and red; the blue being on the top, and then the colours white and red. On the one side, within a wreath, are the words, "VIVER. LIBER. I.O. MORIRE" in gold, evidently the Corsican patois for *Je meurs pour vivre libre;* and on the reverse "Républica-Francese." Napoleon was the first colonel of the regiment.

A peculiar interest attaches to these five colours. They are among

[1] Le 26^e Régiment, formerly Le Régiment Bresse, was formed in 1775 from the 2nd and 4th Battalions of the regiment of Poiton, and in 1794 was incorporated in the 52nd Demi-Brigade.



Drapeau du 26[e] Régiment d'Infanterie, 1791-94.

Drapeau du 52[e] Régiment d'Infanterie, 1791-94.

the earliest French colours known to be in existence,[1] and are associated with the hero of Trafalgar, having all been taken at Bastia and Calvi, when, as captain of H.M.S. "Agamemnon," Nelson was serving on shore during the operations in Corsica in 1794. Little was known of their history until M. Hollander recently came over from Paris, made sketches of them, and published an interesting description of two of them in the March number of the *Carnet de la Sabretache*. To M. Hollander I am much indebted for sketches of the other three flags and a description of them.

The relations between the naval and military commanders in the campaign in Corsica were exceedingly strained. The admiral, Lord Hood, was anxious to push on at once and attack Bastia, but Major-General David Dundas refused to co-operate unless he had a reinforcement of 2,000 men from Gibraltar. Hood was urgent, Dundas was obstinate; and the bitterness of the letters which passed between them was but scantily veiled by the forms of official courtesy. On the 5th March Dundas wrote :—" I consider the siege of Bastia, with our present means and force, to be a most visionary and rash attempt, such as no officer could be justified in undertaking." Hood replied :—" I must take the liberty to observe that, however visionary and rash an attempt to reduce Bastia may be in your opinion, to me it appears very much the reverse, and to be perfectly a right measure; and I beg here to repeat my answer to you, upon your saying two days ago that I should be of a different opinion to what I had expressed, were the responsibility upon my shoulders—'that nothing would be more gratifying to my feelings than to have the whole responsibility upon me'—as I am now ready and willing to undertake the reduction of Bastia at my own risk with the force and means at present here."

Major-General David Dundas, unable to agree with Lord Hood, gave up the command, and was succeeded by Brigadier-General Abraham D'Aubant. But like his predecessor, D'Aubant refused the venture, although he had some 2,000 fine troops under his command; and it has to be confessed that what two British Generals were afraid to co-operate in, the Navy undertook without their assistance. On 4th April, 1794, the following troops, which had been serving on board ship as marines, with sixty-six artillerymen, were landed from the fleet under command of Lieut.-

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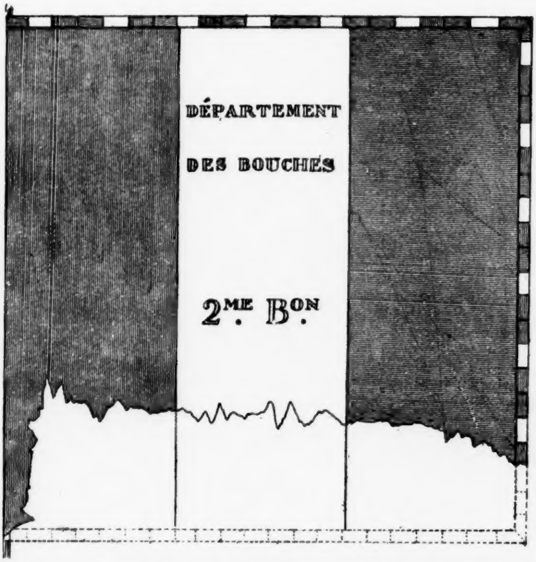
[1] Le 52[e] Régiment, formerly Le Régiment La Fére, was formed in 1654, and in 1796 was incorporated in the 103[rd] Demi-Brigade.

Le 1[er] Bataillon de l'Aveyron was raised in 1792, and in 1794 was incorporated in the 16th Demi-Brigade of Light Infantry.

Le 2[e] Bataillon des Bouches du Rhône was formed in 1791, and in 1794 was incorporated in the 15th Demi-Brigade of Light Infantry.

This is one of the four battalions of Volunteers formed in Corsica in 1791. The Italian inscription is accounted for by the Italian language having been preserved on the union of the island with France.

Drapeau du Régiment de l'Aveyron, 1792-1794.



Drapeau du Régiment des Bouches du Rhône, 1791-1794.

Colonel W. A. Villettes, 69th Regiment, together with 250 seamen under command of Captain Horatio Nelson :—

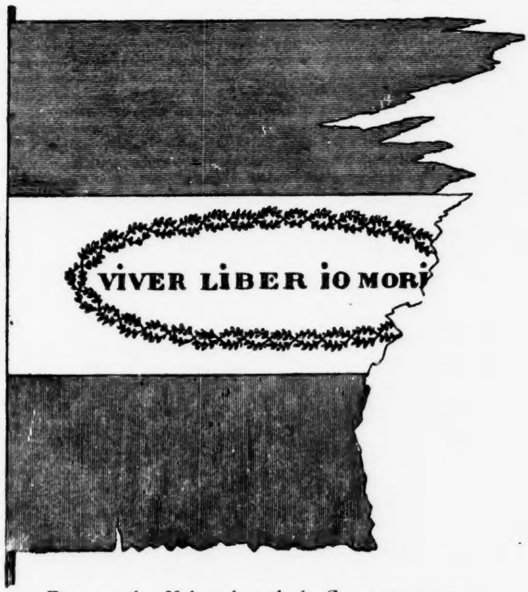
11th Regiment	.. ..	257
25th „	.. ..	123
30th „	.. ..	146
69th „	.. ..	261
Marines ..	.. ..	218
Chasseurs..	.. ..	112

making a total force of 1,433 men. Colonel Villettes and Nelson, who was slightly wounded in the back, worked with the greatest zeal and energy. They had their reward when, on 19th May, 4,500 men, comprising the garrison of Bastia, laid down their arms to under 1,200 British troops and seamen. Included in the garrison were the 1er Bataillon 52^{e} Régiment, 1er Bataillon de l'Aveyron, 2^{e} Bataillon des Bouches du Rhône, and Les Volontaires de la Corse, whose colours, taken possession of at the same time, now adorn the museum of the Royal United Service Institution.

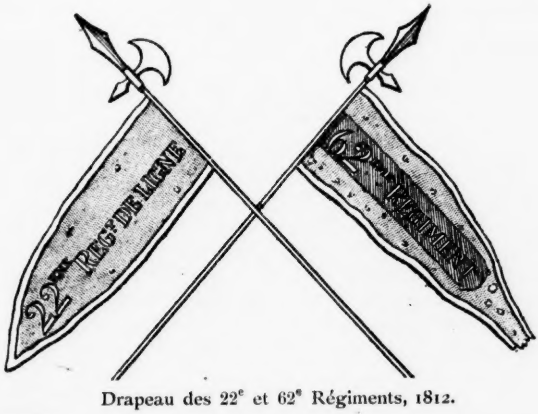
Attention was afterwards directed to Calvi, against which a combined naval and military force of 1,650 men, and some Corsicans, was despatched under Admiral Lord Hood and Lieut.-General the Hon. Charles Stewart. On 19th June the force, which included some artillery, the 2nd Battalion Royals, 18th (Royal Irish), part of 25th, the 30th, 50th, 51st, part of 69th, and part of Royal Louis Corps (French Emigrants), landed. On the 10th August, after a siege of fifty-one days, they had the gratification of receiving the surrender of the brave French garrison. The flag of the 2nd Battalion 26th French Regiment, already described, was taken possession of by the British. Nelson, as usual, was indefatigable during the siege. At the end of July he wrote, "Nothing but the loss of a limb would have kept me from doing my duty"; he had been so severely wounded by the splinters and stones from a shot fired from the town on 10th July, that he lost the sight of his right eye.

In the third window on the western side of the Banqueting Hall are two rudely-fashioned French Provisional standards, presented to the Institution by the late Lieut.-General Sir Henry Bunbury, Bart., K.C.B. They belonged to the 22^{e} Régiment d'Infanterie and the 62^{e} Régiment d'Infanterie, and were captured on 22nd July, 1812, in Wellington's great victory over the French at Salamanca. They were brought home by Captain Lord Clinton, 16th Light Dragoons (aide-de-camp to Lord Wellington), who, we are told in the despatch, had the "honour of laying at the feet of H.R.H. the Prince Regent the eagles and colours taken from the enemy in this action." A mystery surrounds them. It is said[1] that by an order of 22nd July, 1813, Marshal Soult directed all regiments under a certain strength to return their eagles to their depôts; and that

[1] Mr. Andrew Ross, "Old Scottish Regimental Colours," p. 68.



Drapeau des Volontaires de la Corse, 1791-1794.



Drapeau des 22e et 62e Régiments, 1812.

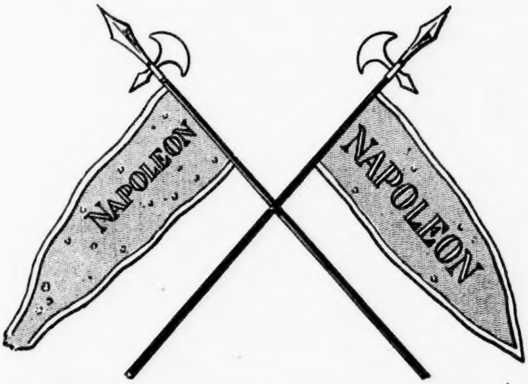
the soldiers, deprived of their eagles, felt so strongly the need of a rallying point that they manufactured standards for themselves—rude, indeed, in comparison with the noble insignia which had been sent back to France, yet still possessing the mighty virtue of symbolism, and which sentiment made them rally around and defend to the uttermost. These two particular standards were, however, captured a year before Soult's order was issued, and an eagle of the 22nd as well as the Provisional standard of that regiment was taken at the same time.[1] It seems more probable that these rudely-fashioned standards were either carried by battalions which had already lost their eagles, or by battalions which had not as yet earned them; they were not camp colours, as some persons imagine.

Suspended from the gallery at the southern end of the hall are five Chinese flags—distinctions which were very numerous in the army and navy of the Celestial Empire—and were secured in such a wholesale manner that they soon ceased to inspire any veneration at our hands. Two of them are very large, and are relics of the first China War of 1841-42. One is an important banner bearing the design of the Imperial Dragon. The other is an enormous flag on a staff surmounted by an ornamental flat head of fine brass. They were both taken when the Island of Chusan was captured on the 1st October, 1841, and were presented to the Royal United Service Institution by the late Admiral Sir Edward Belcher, K.C.B., F.R.S.

Recent years have witnessed quite a revival in the interest which at one time attached to the colours of British Regiments, and it is very satisfactory to notice the growing concern amongst officers that an honourable place of retirement should be found for those sets which have from age and other causes ceased to do active duty. It would appear appropriate that colours, which before entering upon service, received the consecration of the Church, should eventually find a home in the local places of worship territorially connected with their regiments. And, where a due appreciation of the value which officers set upon the colours of their battalions is instilled into the minds of those to whom they are entrusted, the custom has much to commend it. Unfortunately, experience has proved that these relics have in many instances been not only grossly neglected by the clergy, but have been lost and even destroyed. Churches are usually damp, and damp is most destructive to the material of which colours are made. When, during the repair of St. Paul's Cathedral in 1820, the standards and colours captured in Marlborough's campaigns were taken down, they were found to have utterly perished: not a rag remained. In these circumstances it may be urged upon officers that in no place in the United Kingdom are the old colours of regiments in such safe keeping as in the hands of the Royal United Service Institution, where they are preserved with a veneration never likely to be accorded

[1] An aquatint engraving of the trophies captured at Salamanca, and published at the time, hangs alongside them in the Banqueting Hall.

to them elsewhere, and where they are seen to the greatest advantage. The officers of the 1st Battalion Oxfordshire Light Infantry, following the example of the 52nd, have, within the last few months, deposited their old colours in the Museum of the Institution. Is it too much to hope that other distinguished regiments will follow their example?



Drapeau du 22^{e} et 62^{e} Régiments, 1812. *Reverse.*

THE 14TH LIGHT DRAGOONS AT CHILLIANWALLA.

By General C. W. THOMPSON, Colonel 14th (King's) Hussars, and Viscount CHETWYND, late Lieut. 14th Light Dragoons.

SIR CHARLES GOUGH'S account of the battle of Chillianwalla, in the last March number of the R.U.S.I. JOURNAL, has stirred the memories of some survivors of the 14th Light Dragoons, who are anxious that the whole truth should be known of the strange mishap which befel Pope's cavalry brigade on that occasion.

After standing dismounted for some time in column during the afternoon of the 13th January, 1849, listening to the heavy firing on our left, but unmolested by the enemy, the brigade was ordered to mount and deploy, which it did deliberately, two squadrons of the 9th Lancers under Major (afterwards Sir) Hope Grant on the extreme right, then three squadrons of Native cavalry in the centre, with four squadrons of the 14th Light Dragoons on the extreme left of the brigade—nine squadrons in all, standing as above stated and not chequered by wings in the manner depicted at p. 241 of Sir Charles Gough's account. As commanding the 2nd squadron of the 14th (the 7th from the right of the general line of the brigade), I had a good view to front and flanks, and can attest that, to the best of my belief and recollection, the whole of the Native cavalry were on our right, forming the centre of the brigade line. The 14th were on the left of the brigade from the first, and remained so throughout the day. Having previously drawn swords, the brigade was now ordered to advance at a trot, without a skirmisher or "scout" in front or a man in support or reserve in rear, through broken, jungly ground, where some of the enemy's horsemen were seen to loiter, watching our movements. Brigadier Pope himself led the line in front of the Native Cavalry, forming the centre by which we had been ordered to dress and regulate our pace, when insensibly its "trot" dwindled to a "walk" and then came to a dead halt at the sight of a few Sikh horsemen peering over the bushes. Of course the flanks of the brigade had to do the same, being guided by the fluctuations of the centre which were not always clearly visible in the thick jungle, but were conformed to more by sound than by sight. I then saw Colonel King, commanding the 14th Light Dragoons, gallop to the Brigadier in front, energetically pointing with his sword towards the enemy's position and evidently urging an attack, which the other seemed unable to make up his mind to order. The Sikhs seeing the hesitation, a handful of their horsemen, some forty or fifty in a lump, charged boldly into the thick of the Native cavalry, who instantly turned with the cry in English of "threes about," and disappeared for the rest of the day—at least I saw none of them.

This word of command, uttered authoritatively, was unfortunately repeated by the remaining squadrons in succession, but was no sooner

found to be a mistake (as it might have been at a Field Day) than the "halt" and "rally" were sounded amid redoubled shouts of "halt!" from the officers, and the European Lancers and Dragoons were found in an open space like a ploughed field in the jungle facing to the front, where Lord Gough and staff shortly after rode by and were received with "carried swords." Why the order was not immediately given to advance and recover the two abandoned guns I never knew, but the Brigadier had been badly wounded in the retreat (not in the advance, as stated by Sir Charles Gough), the men were naturally disappointed by the unexpected failure, and perhaps it was prudent not to attempt too much at the time. Among the sights and sounds of the rallying troops, which have never faded from my recollection for the last forty-six years, I was much struck by the speech of a dragoon who, reining up his horse in line with the others, exclaimed, "Ah, poor old Billy Havelock, if you had been here this would not have happened," referring not to his immediate commanding officer—who had done all that a good soldier could do under the circumstances—but to the general handling of the brigade, which every one could see was pitiable in the extreme. Those who remember *El chico blanco*, "the fair boy," of "Napier's History of the Peninsular War,"[1] and witnessed the gallantry with which he "rode into the jaws of death" at the head of his regiment at Ramnuggur a few weeks before, will appreciate the force of the dragoon's homely remark. Colonel William Havelock, K.H., was the elder brother of Sir Henry Havelock, the hero of Lucknow, whose statue stands in Trafalgar Square, and at the time of his death in November, 1848, was much the more distinguished of the two.

Of the Honourable East India Company's (not Royal) Horse Artillery attached to the brigade I remember little, and do not think that they fired a shot during the advance. Following uselessly in rear, it was rumoured at the time that when the artillery officers complained to the Brigadier that he was masking their guns in such a way as to prevent their opening fire, nothing was done to rectify this essentially false position—not even the simple expedient of dragging the guns into the squadron intervals, where they would have been comparatively safe, if unable to fire. In rear they were and in rear they remained until the line turned, when they turned with it, adding much to the confusion by blocking the way and some of them sticking fast and upsetting among the bushes, where they were captured by the enemy.

As illustrations of the scrambling nature of the *mêlée*, where so much was left to individual action and so little to superior command, I may mention that during one of our short rallies, followed by the enemy, Lieutenant Augustus John Cureton, a gallant youth of eighteen years of age, son of a gallant father, Brigadier-General Cureton, killed at Ramnuggur a few weeks previously, was seen to turn back and ride alone into the jungle, from which his horse shortly returned riderless; and I saw Cureton's body brought into camp a fortnight later, recognisable only by the sleeve of a regimental jacket on one arm.

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[1] Vol. V. p. 139.

In the course of the fight in the jungle several hand-to-hand encounters took place, not all to the advantage of the enemy. Major Stewart, of the 14th, overtook a Sikh horseman belabouring an artillery Officer (Captain Huish, I believe), and blew him out of the saddle *en passant* by a snap pistol-shot in the breast. Being immediately attacked by another Sikh sword in hand, the Major had not time to return his pistol (a long single-barrelled old-fashioned "horse pistol"), but guarded with the barrel, from which the native's sabre glanced off, inflicting a slight cut inside the right arm, and Stewart came into camp bleeding profusely, but not seriously. His antagonist fortunately did not renew the attack, but rode away into the jungle.

One of our Troop-Sergeant-Majors seeing a *ghorchurra* (Sikh horseman), conveniently in front gave him a prod in the back, where the point of the sword became so firmly fixed that the exertions of neither party, pulling different ways, could separate them until the dragoon's sword-knot broke, and the Sikh rode off with the sword sticking in his back, apparently little the worse. Probably the presence of chain armour under a cotton-quilted jacket or *mirzai*, as generally worn by natives in cold weather, might account for this singular occurrence.

In his "Reflections" on Chillianwalla, Sir Charles Gough is mistaken in stating (p. 245), that "the charge [of Pope's brigade] was badly delivered, and, instead of increasing the pace, the line was brought almost to a trot at the moment of collision." There was, in fact, no charge and no collision except the partial one above related, and on this point I can speak decidedly from my position as leader of the 2nd squadron of the 14th enabling me to take an uninterrupted view of the front as far as the centre, by which we were ordered to dress.

Had the "charge" or even the "gallop" been sounded all would have been well, for the men were in high spirits, and on drawing swords and trotting they fully expected the charge to follow (though there was hardly any enemy visible in front among the bushes of the broken jungle), when the gradual decrease of pace and sudden halt in the centre struck the first vague note of suspicion that something was wrong somewhere, though no one knew *what* it was nor *where*. And upon this the cry of "threes about" arose from the Native cavalry, was passed down the line from squadron to squadron, and the catastrophe took place. The experience of the two squadrons of the 9th Lancers on the extreme right appears to have been much the same, as related by their commander, Major (afterwards Sir) Hope Grant, in his official report of the 15th of January, given in his "Life," Vol. I. pp. 136-138.

"The 9th Lancers," he writes, "were dressing upon the 6th [Native] Light Cavalry, I think. . . . There were some few of the enemy now seen in our front, but nothing in the force to stop any body of Europeans. . . . The two squadrons were going along with the line steadily, and no hesitation was evinced ; on the contrary, the flank-men were engaged with some of the enemy, and doing their duty, when the whole line checked and went about from the left, and my squadrons, certainly without a word from me, turned round too."

It will be observed that Major Grant states above that "the whole line checked and *went about from the left*," i.e., *his* left, which doubtless was the case. My experience as 2nd squadron leader of the 14th when in line, was that the movement or "wave" of retreat, together with the apparently authoritative words of command, came from the right, which would show that the disorder originated at some intermediate point between the two British regiments, viz., at or near the centre of the brigade line, held by the Native cavalry, as really was the case. Sir Charles Gough labours to disprove this by placing the 14th at or near the centre (where they never were), and, speaking of the whole brigade as though the troops composing it were all of the same stamp, concealing the individuality of the Native cavalry under the generic title of "British." "Now occurred what, happily, is a rare event in the annals of British cavalry," he says, as if the Native cavalry of that day had any right to be considered British beyond the fact of being armed, mounted, and paid by the East India Company; or as if they were not on this occasion the authors of the mischief.

At that time, forty years ago, as Sir Charles will perhaps remember, there was no love lost between the Queen's and Company's services, and the mishap of Pope's brigade (himself a Company's officer) was hailed with something not unlike satisfaction by the local troops, as involving the reputation of two regiments of Peninsular fame, and cloaking the shortcomings of their own favourite Native cavalry.

In corroboration of the above account, I am happy to possess the following letter from the Serrefile of the 2nd squadron, the Hon. R. W. (now Viscount) Chetwynd, whose reminiscences in great measure confirm and supplement my own. With one witness in front and another in rear of the line, as he and I were then placed, at different points of view, yet at no great distance from each other, it is hardly possible to suppose that anything of importance could escape our observation. May the truth of our evidence tend to clear up the mystery of this "inexplicable" defeat, and place the saddle of responsibility "on the right horse"!

C. W. THOMPSON,
General. Colonel of the 14th (King's) Hussars.

July 5th, 1895.

MY DEAR THOMPSON,

Having been the Serrefile of the squadron of the 14th Light Dragoons, which you led at Chillianwalla, I should like to state to you, as the present full Colonel of the Regiment, my impression of the account by Sir Charles Gough of Pope's brigade (including the 14th), published in the March number of the JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION.

Sir Charles begins by saying that the Brigadier "was to blame for his manner of handling his cavalry. Without consideration he ordered the nine squadrons under his immediate command to advance to the attack in one long line, without support or reserve, thereby preventing the guns

from opening fire." So far, Sir Charles is, I believe, perfectly correct, but now begin his mistakes. The first I shall mention is, as to the wounding of the Brigadier. I believe it occurred in the retreat, and that he was still leading the line in person when it turned: in which case the Brigadier's being wounded would have no part in breaking down the advance, as Sir Charles suggests it had. I now come to another mistake, of greater importance. Sir Charles says: "the charge was badly delivered, and instead of increasing the pace, the line was brought almost to a trot at the moment of collision," clearly implying that the order to gallop had been given and acted on.

A complete misstatement from beginning to end, as regards the 14th, for they received no order whatever to gallop, and consequently continued at the trot. As for delivering a charge, or any collision, I saw nothing of the kind. There was only one increase of pace in the 14th from the walk to the trot. The reception of the order for that by your squadron was to me a fine and impressive sight.

As to the going about, Sir Charles speaks of some "wholly inexplicable" cause. This "inexplicable" cause was, in your squadron, exactly what the Duke of Wellington stated it to have been in the House of Lords: "a word of command from some unauthorised person." I heard the word and obeyed it, as did the men in front of me, and so we began trotting back again. Sir Charles further describes the going about as commencing in "the centre regiment" and "about the centre of the brigade," having previously placed the 14th between two wings of Native cavalry. He is, I believe, right in saying that the going about commenced in the centre, but wrong in placing the 14th there, they being, I believe, on the left of the brigade. This has its importance, but not equal to that of what follows.

Proceeding to the retreat, Sir Charles refers to it twice, in one place speaking of a "portion of the brigade," in the other of the whole. He means, I think, the same thing in both places, viz., the nine squadrons forming the line led by the Brigadier, a part of the brigade being detached to cover the flank. These troops Sir Charles describes as "breaking into a reckless stampede, galloping to the rear, and riding right down upon the ten guns . . . . upsetting and disabling them." Now, anyone deriving his information from this description would certainly understand that these troops, including the 14th, turned, went off at a gallop, and rode straight into the guns, upsetting and disabling them. Very different from what I saw in your squadron.

The squadron came about as already described, there being, as far as I could see just previously, only scattered horsemen in their front. Presently, as we were trotting to the rear, I heard a counter-order, which checked us, but was not obeyed; in my opinion, as I will explain, from the want of something to halt upon. I shortly saw ahead two of the ten guns Sir Charles describes as being ridden over and upset. The sight of them at once steadied us, because it supplied what was wanting—a common halting point. There was every appearance of a halt upon the

guns, when, as we were approaching with our attention fixed on them, off they started, with a fatal effect upon us. But this is not riding over guns and upsetting them; on the contrary, they upset us. As regards these two guns then, Sir Charles's description is, beyond a doubt, very unjust to the 14th, even if—which is quite possible—they afterwards came to grief.

Further than that, it is, I think, not unreasonable to look upon what I saw in your squadron as some indication of the *morale* of the other three at the same time. They may or may not have had assistance, such as we had in the counter-order and seeing the guns in time. Some such assistance was wanted; as the Duke of Wellington pithily expressed it, "a movement in retreat is not a movement in advance."

In my opinion, founded on the incident of the guns, it was the fact of the 14th being unsupported that made the going about fatal, and occasioned the loss of the guns and artillerymen. Supporting troops in the place of those guns would have stopped the mischief at once.

Those unsupported guns I take to have been in great danger, in any event, from the moment the unsupported cavalry advanced in front of them, and to have been victims of the bad generalship, as the 14th themselves were.

I object then to this narrative of Sir Charles's, as unjust to the 14th, from its misstatements of fact, both as to the advance and the retreat, and also from its general character—a short dry statement that the brigade was badly commanded, without a word to connect the results with this cause. Positively, the word "*support*" only occurs once in Sir Charles's narrative; the matter of leadership is then put aside, and the alleged results are attributed to the cavalry alone, as though the guns and the leadership had no part in them.

Whether such an account from a general officer of Sir Charles Gough's services should remain uncorrected is a question I leave to you, as the full Colonel of the 14th. If you determine to communicate with the Editor of the JOURNAL on the subject, you are welcome to send him this letter if you think fit.—Yours sincerely, CHETWYND,

Late Lieutenant 14th Light Dragoons.

To General Thompson,
Colonel of the 14th Hussars.

NAVAL AND MILITARY NOTES.

NAVAL.

HOME.—The following are the principal appointments which have been made: Captains—V. A. Tisdall to "Sappho"; E. N. Rolfe, C.B., to "Repulse"; J. Ferris to "Champion"; H. H. Dyke to "Comus." Commanders—Hon. H. Tyrwhitt to "Surprise"; F. C. Noel to "Scout"; E. A. Simons to "Melita."

The third class cruiser "Comus" is to proceed to the Pacific to relieve the "Hyacinth"; the "Sappho" takes out new crews to Malta for "Scout" and "Melita"; while the "Champion" takes the place of the "Ruby" in the Training Squadron.

The new second class cruiser "Minerva" was floated out of the dock at Chatham, where she has been built, on the 23rd ult. The ship is one of the second class cruisers of the "Talbot" class laid down as part of the new programme which followed the "Hamilton programme." She is built of steel, and her dimensions are as follows:—Length, 350 feet between perpendiculars, and extreme breadth 53 feet 6 inches. The designed draught of water is 19 feet 6 inches forward and 21 feet 6 inches aft., at which the displacement will be 5,620 tons. The launching weight was 2,500 tons. She will be armed with five 6-inch Q.F. guns, six 4·7-inch Q.F. guns, nine 12-pounder Q.F. guns, and five guns of a smaller nature. There are three firing tubes for Whitehead torpedoes, two of which are submerged. The engines are of the now universal pattern in her Majesty's ships, being of the three-stage compound, vertical, inverted, direct-acting type, the estimated H.P. under forced draught being 9,600 indicated. At the displacement and power estimated the speed anticipated is 19·5 knots. The coal capacity is 1,020 tons. The full complement of officers and men will be 436. The "Minerva" is a protected cruiser, and has the usual protective deck, which is 1½ inches thick on the level part and 3 inches thick on sloping portion at the sides. There are armoured steel coamings 5 inches thick to protect the cylinders, and the conning tower is of 6-inch steel armour. The propelling machinery has been entirely constructed in the dockyard, and an inspection of the engines as they stand ready erected in the shops was made by the Commander-in-Chief after the launch. These engines, as already stated, are of the three-stage compound type. The cylinders are 33 inches, 49 inches, and 74 inches in diameter by 3 feet 6 inches stroke. They have been designed as well as constructed in the dockyard, and bear a strong resemblance to the Forte's engines, also designed in this yard. All cylinders are separate castings, each engine—that is, each cylinder with its attendant parts—standing alone, although bracketed to its fellows by struts and tie rods. The high-pressure cylinder has a piston valve, the other two valves being ordinary flat valves. Each set of engines will be placed, in a water-tight compartment, being thus separated by a fore and aft bulkhead. There will, however, be a water-tight door in the latter, as usual, and the arrangement of starting and reversing gear is such that all levers are brought against this bulkhead, so that the engineer officer in charge of the watch has both sets of engines fronting him and those who are operating them within a short distance. The boilers are also completed. They are eight in number, and are of the ordinary return tube, single-ended marine type, being 14 feet 6 inches in diameter,

and having three Fox's furnaces in each. The front plate in these boilers is a somewhat remarkable piece of work, being composed, all except a small part at the top, of two plates which have been welded together and afterwards flanged as a whole. The work appears to have been most successfully performed, and reflects great credit on the dockyard engineering department. The foundations for the engines are mostly of cast steel, being of the light pattern which was first introduced by the late Dr. Kirk, and which has now become so general for vessels of war. Perhaps there is nothing more striking in the modern warship engine than the light nature of the framing and foundations, as compared with the massive crank shafts and large bearing surfaces, which are now wisely given. The "big-ends" of the connecting rods, when they are attached to the crank pins, are of quite fashionable dimensions in the "Minerva's" engines, and promise smooth running with cool bearings even with the high piston speed now demanded. The cross girders forming the plummer's blocks are of cast steel, but the longitudinals connecting them are of iron. These cross girders are straight in thwartship vertical planes, but are let into the longitudinals. Naturally the longitudinals of the vessel itself will be strengthened in engine space.—*Times.*

At the Fairfield shipbuilding yard, Govan, Glasgow, on the 5th ult., the second class protected cruiser "Venus" was successfully launched. The "Venus" is the first of six cruisers built in private yards, and her dimensions are:—Length between perpendiculars, 350 feet; breadth, 54 feet; and displacement, 5,600 tons. She has a cellular bottom extending the full length of her engines and boiler spaces. Her hull is built of Siemens-Martin steel, and the vessel has a ram stem. The "Venus" is protected by a curved deck of 3 inches to 1½ inches, and her engines are further protected by an armoured steel citadel. Her crew all told will number 450. Her armament will consist of five 6-inch, six 4·7-inch, and eight 12-pounder Q.F. guns, besides a number of smaller guns. Two submerged torpedo-tubes are fitted forward, and one above water aft. The normal bunker supply is 550 tons, but provision is made for carrying a further large supply when necessary. The propelling machinery consists of two sets of triple-expansion engines, having cylinders of 33 inches, 49 inches, and 74 inches in diameter respectively, with a stroke of 3 feet 3 inches. Steam will be supplied at a working pressure of 155 lbs. from eight single-ended boilers, and under forced draught the speed expected is 19·5 knots.

The first 30-knot torpedo-boat destroyer, ordered in May last by the Admiralty, was sent afloat on the 26th ult. from Messrs. Laird Brothers' works at Birkenhead, eighty-eight working days after the laying of her keel. Her sister-ships, lying in close proximity, are growing quickly. The new vessel was named the "Quail" by Mrs. William Laird, and placed in one of the graving-docks to receive her machinery and be otherwise completed. The "Quail" is the largest and perhaps the most complete boat of her class yet designed, and, irrespective of her speed, she will have great power of endurance, and will carry coal enough to steam at a moderate speed to the Mediterranean, or even, if need be, across the Atlantic. In view of the high rate of speed lately attained by the "Sokol," built by Yarrow for Russia, viz., 30·2 knots, and the 31·0 knots also made by the new French torpilleur-de-haute-mer "Forban," the trials of the new 30-knot destroyers for our Service are being anxiously awaited.

The Admiralty have intimated to the officials at Chatham Dockyard their desire that the new first class battle-ship "Magnificent" shall be completed and fully equipped by December 12th, on which date it is proposed that she shall be commissioned. Should this be carried out, the dockyard will have accomplished a very notable performance. The first keel plate was laid down on December 18th, 1893, and the vessel was launched on December 19th, 1894; so that the construction of the vessel will have been finished within a period of two years. Her sister-ship the "Majestic" is also to be ready for commissioning on the same date at Portsmouth.

The following *résume* of the steam-trials of the "Magnificent" and "Majestic" is drawn from the exhaustive reports of the trials in the *Times*. The new battle-ship "Magnificent" completed her steam trials successfully last month. The trials were looked forward to with great interest, in order that the result of the steam-producing power of her boilers, which are fitted for the application of induced draught to the furnaces, with open stokeholds, might be compared with similar boilers with forced draught and closed stokeholds. In the case of the "Magnificent," the higher efficiency of her boilers is attained by fitting large air suction fans in their uptakes, which are run at a speed that will cause a less pressure in them than with mere natural draught; and thus to suck or draw, by difference of pressure, the ordinary air of the stokeholds through the fuel in the furnaces instead of forcing through what is practically compressed air, as when the closed stokehold system is adopted. To create this induced draught the "Magnificent's" boilers are fitted with eight air fans, each 8 feet 6 inches in diameter, driven by independent engines, which can be worked together or separately, as may be required, provision being made for returning to natural draught at any moment.

On the morning of the 30th August, at 7 a.m., the ship left her anchorage and proceeded to sea on an eight hours' natural draught full-speed trial of her engines. In an hour after leaving the Nore with a pressure in the boilers of 150·5 lbs. per square inch and an air vacuum in the uptakes of 1·4 in. of water, the engines were put at their full speed, and for the eight hours' running the following mean results were attained :—

—	Vacuum in condenser.	Revolutions per minute.	I.H.P.	Total I.H.P.	Speed of ship in knots per hour by log.
Starboard engines	26·3	95·48	5,026	10,301	16·5
Port engines	26·8	96·51	5,275		

After sweeping tubes and thoroughly examining all engine and boiler fittings and connections, the ship early on the morning of the 1st September, got under way and proceeded to sea for a continuous four hours' full-powered trial under induced draught. At 8.45 a.m., having made a good offing, with the engines going at 100·85 revolutions per minute, steam at 154 lbs. pressure per square inch, and an air vacuum in the uptakes of 2·1 inches of water, a direct course was steered and maintained for four consecutive hours without stoppage of any kind. Steam was easily maintained throughout, in fact, it was blown off, at the full boiler pressure. The resulting work of the engines and speed of the ship is recorded in tabular form below :—

—	Vacuum in condenser.	Revolutions per minute.	I.H.P.	Total I.H.P.	Speed of ship in knots per hour by log.
Starboard engines	26·0 in.	99·8	6,002	12,157	17·6
Port engines	26·6 in.	100·8	6,155		

From this it will be seen that the total mean H.P. developed was 157 in excess of that contracted for; the speed of the ship with this power being slightly above that estimated by her designer.

The temperature of the stokeholds during the induced draught trials was never high. This was due to the fact that they are always open to the external air, while in the case of forced draught they are shut off entirely from it. An

important point in the application of induced draught to boilers is the keeping of the temperature of fan chambers and casings as low as possible. This is provided for by the application of asbestos linings and ample air passages around them.

The propelling machinery of the "Magnificent" is designed to develop 10,000-I.H.P. under natural draught and 12,000 under forced draught. It consists of two complete sets of triple-expansion engines in separate engine-rooms, each having three inverted cylinders of 40 inches, 59 inches, and 88 inches diameter respectively, with a piston stroke of 51 inches. Each set of engines drives a four-bladed gunmetal screw propeller 17 feet diameter and 19 feet 9 inches pitch, the crank and propeller shafts being of forged steel. Steam is supplied to the engines by eight single-ended boilers of the ordinary cylindrical marine type, with four furnaces in each, and are made for a working pressure of 155 lbs. per square inch. They are designed to supply sufficient steam for the engines to develop 10,000-I.H.P. under natural draught and 12,000 with induced draught. The ship has coal bunker capacity provided for 1,850 tons, equal to a coal endurance for twenty-eight days at a 10-knot speed, the coal carried at her load draught being about 900 tons.

The "Magnificent" is 390 feet between perpendiculars, has a beam of 75 feet, and her mean draughts at the time of the trials were 24 feet 11½ inches for the natural, and 24 feet 8½ inches for the induced draught. Her fully-loaded displacement is about 14,900 tons. She was laid down on December 18th, 1893, and floated out of the dock she was built in on December 19th, 1894, so that within twenty and a half months she has been built, engined, and so far completed as to have undergone her steam trials, a rate of construction unprecedented in the annals of our Royal dockyards and private engineering establishments.

As opinions are divided as to the advantages of induced over forced draught applied to marine boilers, the trials of the "Magnificent" have been looked forward to with special interest. They are so far conclusive as to prove that an increased pressure of steam may be more quickly raised and maintained. There is also a decided gain so far as the health, comfort, and safety of all who are engaged in the boiler stokeholds are concerned.

On the morning of the 3rd ult., the ship left her anchorage at the Nore and proceeded to sea under easy steam. Arriving off the Tongue lightship at 3.15 p.m., the thirty-hours' consumption trial was commenced and continued, the ship running down Channel until abreast of the Start, when she was put about and finally finished the trial at 9.15 p.m. on the 4th when off Dover. The trials were undertaken for the purpose of ascertaining the consumption of coal per H.P. per hour, for a given indicated power which had been fixed at 6,000 horses, and to determine what speed of engines and steam pressure in boilers would be required. The results attained on the whole thirty hours' run showed that with a steam pressure of 133 lbs. per square inch and eighty-two revolutions of the engines per minute the I.H.P. developed by the engines was 6,086 and the consumption of coal 1·67 lbs. per H.P. per hour. This was considered very satisfactory, as the boilers were worked with natural draught only throughout the whole of the run, and the engines were never stopped from the time of the commencement to the finish of the trials. The trials were favoured with exceptionally fine weather, and were remarkable for the smooth working of the propelling machinery throughout, and the ease with which steam was maintained in the boilers.

The steam trials of the "Majestic" commenced at Portsmouth on the 12th ult. After leaving Portsmouth Harbour the ship proceeded out to sea, and had her eight hours' steam trial under natural draught. She steamed until within sight of Portland, and then returned. The trials were considered highly satisfactory. The draught of water was 25 feet aft and 24 feet 11½ inches forward. The vacuum was 27 for the starboard engines and 26 for the port engines, and when working at 100·7 and 100·3 revolutions per minute the I.H.P. developed was 5,254 for the

starboard engines and 5,164 for the port, giving a total of 10,418, which is 418 above what was contracted for. The speed realised according to the patent log was 16·9, and the coal consumption per I.H.P. per hour was 2·07. On the 18th ult., the ship underwent a four hours' forced draught trial of her machinery. The vessel soon ran into a thick fog bank, and was considerably delayed in consequence, but the fog subsequently cleared, and after a splendid run the ship returned to Spithead about half-past six and reported that her trials had been thoroughly satisfactory. According to contract her I.H.P. was to be 12,000, but the total realised was 12,097, and a speed of 17·9 knots was obtained with her engines making 106 revolutions, mean average, per minute. The air pressure was ·9.

Owing to some defects in her condensers, due to her grounding, the thirty hours' trial for coal consumption has been deferred. The "Majestic's" propelling machinery has been constructed by the Naval Construction and Armament Company (Limited). It consists of two sets of triple-compound, vertical, direct-acting engines, arranged to work twin screws, and when making 100 revolutions a minute they will, according to the contract, develop a total of 12,000-H.P. The high-pressure cylinders are of 40 inches diameter, intermediate 59 inches, and the low pressure 88 inches diameter, all having a stroke of 51 inches. The valves are of the piston description for the high-pressure cylinders, and double-ported slide valves for the intermediate and low-pressure cylinders, all actuated by ordinary—the double-bar link—motion. The back columns of the framing are cast steel of the inverted Y shape securely tied together at the top by a wrought steel plate, and form the piston-rod guide supports; the front columns are of forged steel, and are strongly braced by horizontal and diagonal stays. The bottom frames are of cast steel connected together by cast-steel girders, and secured to the frames of the ship. The main and auxiliary condensers are of brass throughout, and have a cooling surface of 13,500 square feet and 1,800 square feet respectively. There are also in the engine-rooms two main-feed pumps, two evaporators and distillers, four bilge and fire engines, two auxiliary air and circulating pumps, four powerful centrifugal pumps, one drain-tank pump, two ventilating fans, two reversing engines, and two turning engines. There are four separate boiler compartments, each containing two single-ended cylindrical return-tube boilers 16 feet 4 inches diameter by 10 feet 3 inches long. Each boiler is provided with four corrugated furnaces, and has two combustion chambers. The working pressure for the boilers is 155 lbs. per square inch. There are 22,000 square feet of heating surface and 820 feet of grate surface. Under the boilers a special precaution has been taken to filter the feed water after it passes from the condensers. This is done by means of a special apparatus, which extracts all the grease from the water, it having been found that when greasy water finds its way into the boilers it has a very deteriorating effect on the plates. The boiler rooms are provided with an auxiliary feed pump and forced-draught fans. Auxiliary machinery rooms are placed at either side of the ship, containing dynamos, air compressers, ventilating fans, and workshop machinery.

At Portsmouth the authorities are much gratified at the rapid way in which the "Majestic" has been constructed and prepared for her steam and gun trials. It may be remembered that the "Magnificent" was launched at Chatham on December 19th of last year, a year and a day after the first keel-plate was laid. The "Majestic," however, was floated out of dock on January 31st of this year, having occupied five days less than the year in building, and whereas the "Magnificent" commenced her steam trials a little over eight months after launching, the "Majestic" begins her trials seven and a half months after launching. In securing this rapidity in the equipment of the ship, the dockyard authorities were much assisted by the machinery contractors. They undertook to deliver the machinery by the end of May of this year, and although at the end of 1893 and since that period they have had a very large number of contracts, yet they

delivered this machinery in the first week in February. Including the "Majestic," the Naval Construction Company have on hand at the present time machinery for the Government to the extent of 71,000-H.P.

FRANCE.—The following are the principal promotions and appointments which have been made: Rear-Admiral—Prouhet to Vice-Admiral. Capitaines de Vaisseau—Gigon, des Portes, and Courrejolles to Rear-Admirals. Capitaines de Frégate—Germinet, Thierry, Krantz, and Leygues to Capitaines de Vaisseau. Vice-Admirals—de la Jailles to Inspector-General of the Navy; Alquier to Member of the Council of Works; Puech to Command-in-Chief of the 1st Arrondissement Maritime (Cherbourg); Prouhet to Command-in-Chief of the 4th Arrondissement Maritime (Rochefort); Régnault de Prémesnil to command of the Squadron of the North. Rear-Admirals—Chauvin to President of Permanent Commission of Control; de Penfentenyo de Kervéréguin to Chief of the Staff to Vice-Admiral Cavelier de Cuverville in command of the Reserve Squadron of the Mediterranean. Capitaines de Vaisseau—Puech to "Formidable"; Gadaud to "Trident"; Aubry de la Noë to the Committee of Inspectors-General of the Navy; Massé to "Suffren;" and Krantz to command of the Squadron in Corsica; Lefèvre to Chief of the Staff to Vice-Admiral Régnault de Prémesnil, Commanding the Squadron of the North; Merleaux-Ponty to Chief of the Staff to Vice-Admiral Gervais, Commanding Active Squadron of the Mediterranean. Capitaines de Frégate—Seurat to "Bien-Hoa"; Lespinasse de Saune to "Fulton."—*Le Moniteur de la Flotte.*

Vice-Admiral Cavelier de Cuverville will hoist his flag on board the "Trident" at Toulon on the 15th inst., as Commander-in-Chief of the Reserve Squadron.

The new first class battle-ship "Brennus" has been undergoing her trials during the past month off Brest; on the first trial, with the engines developing 6,245-I.H.P. out of a possible 13,600, and making 96 revolutions, a speed of 15 knots was attained. On the 6th ult. she made a preliminary full-speed trial, when a speed of 17 knots was obtained with the engines developing 13,200-I.H.P., the consumption of coal per square metre of grate being 125 kilos.

The new torpedo-aviso "Cassini" has commenced her official trials at Cherbourg; with the engines making 190 revolutions, a mean speed of 15·7 was obtained. The new armoured-cruiser "Pothuau," which stuck fast when half-way down the launching-ways on the 22nd August, was successfully launched on the 19th ult. at Havre. The new second class cruiser "Pascal," a sister-ship to the "Descartes," was launched at Toulon on the 20th ult., as also a torpedo-aviso, the "Casabianca," at Bordeaux on the 21st ult.

The Reserve Squadron of the Mediterranean and the Squadron of the North had their crews reduced to the footing of *effectif d'essais* on the 1st inst. The armoured coast-defence ship "Indomptable" has been withdrawn from the Squadron of the Reserve and placed in the 2nd Class Reserve at Toulon.

The Minister of Marine has approved of the contract of the Société des Chantiers de la Mediterranée at Bordeaux for the construction of the new second class cruiser "Protet"; the ship is to be delivered completely finished and ready for her trials in three years from the 5th September ult.; another cruiser of the same type, to be called the "Jurien de la Gravière," is to be constructed at Cherbourg. Both of these vessels are to be of the same class as the "Descartes" and "Pascal," but somewhat modified and improved; their displacement will be about 4,000 tons, with engines developing 9,000-I.H.P., and giving a speed of 20 knots; they will be sheathed in wood and coppered, as they are destined for service on foreign stations. The armament will consist of four 6-inch and ten 4-inch Q.F. guns, besides smaller guns. The Minister of Marine has approved of the contract for one of the two new "corsaire-croiseurs" being given to the

Chantiers de la Seyne, near Toulon, and she is to be called the "Châteaurenault," the name of the other being the "Guichen." These vessels are being built in imitation of the new United States commerce-destroyers "Columbia" and "Minneapolis." Their dimensions will be as follows:—Length, 442 feet; beam, 54 feet; and the draught of water is not to exceed 23 feet 6 inches, with a displacement of 8,500 tons. The boilers are to be water-tube of the Allest type, and the ships are to have three screws, driven by separate sets of engines, each of which are to develop 8,000-I.H.P., giving a speed of 23 knots under forced draught, while the coal supply of 1,500 tons is to allow of a radius of action of 7,500 knots at a 12-knot speed. The armament is to consist of two 16-centimetre (6·3-inch) Q.F. guns, one forward and one aft, and six 14-centimetre (5·5 inch) Q.F. guns, two of which can fire ahead and two astern; all the guns are to be protected by 2-inch steel casemates, while a 5-inch steel hood and shield will also be fitted to revolve with the guns, completely closing the port; each gun will be supplied from its own ammunition tube. The armoured deck varies in thickness from 4·5 inches to 2 inches, and the conning tower will be of 8-inch steel. The hulls of these two cruisers are so designed that they may outwardly present the appearance of ordinary mail steamers. It will be seen that, although with a slight nominal superiority in speed, they cannot be compared with the "Powerful," "Terrible," and the four new first class cruisers building in England.

The new torpedo-de-haute-mer "Forban" is continuing her trials, and in one of her late runs she has beaten the record in speed, having attained the high mean speed of 31·029 knots during an hour's run, the coal consumption being 2,695 kilogrammes per hour. At the time of the trial the "Forban" had on board her torpedoes, guns, crew with effects, stores and water, a total weight of 16,000 kilogrammes. She is a vessel 144·4 feet long, with a beam of 14 feet 6 inches, and a displacement of 136 tons; the armament consists of two 1·5-inch Q.F. guns and two torpedo-tubes; the engines are triple expansion, each supplied by a Normand water-tube boiler.

The following ships are to be put in commission for their trials during 1896:—
First class battle-ships—"Carnot," "Charles-Martel," and "Jauréguiberry."
Coast-defence battle-ship—"Tréhouart."
First class armoured-cruiser—"Pothuau."
Second class cruiser—"Descartes."
Torpedo-depôt-ship—"Foudre."

The following vessels are also to be commissioned for special duties in 1896:—

For Fishery Duties in Newfoundland.

Third class cruiser—"La Clocheterie" for eight months.
Aviso-transport—"Nièvre."

For Fishery Duties at Iceland and in the North Sea.

Second class aviso—"Mouette" twelve months.
Torpedo-aviso—"Sainte-Barbe," and eight cutters.

The Budget also makes provision for laying down the following new vessels:—

One battle-ship "A3" to be called the "Henri IV." This ship is to be built by contract, and will have a displacement of about 8,700 tons; the boilers are to be water-tube, the speed under forced draught 18 knots, and the radius of action at 10 knots, 4,500 miles. The armament will consist of two 30-centimetre (11·8-inch) guns, six 12-centimetre (4·7-inch) Q.F. guns, four 10-centimetre (3·9-inch) Q.F. guns, and twelve 3-pounders and 1-pounder; the complement of officers and men will be 400. The ship will, therefore, be an improved "Bouvines," and is a type which does not meet with the approval of Admiral Gervais and many officers, while Admiral Besnard, the Minister of Marine, attaches, on the other hand, great value to this class of ship.

A new-armoured cruiser "D2," an improved "Dupuy-de-Lôme," is also to be built by contract; her displacement is to be 8,500 tons, speed 20 knots, and a radius of action of 7,700 miles; she will carry two 16-centimetre (6-inch) Q.F. guns, ten 12-centimetre (4·7-inch) Q.F. and sixteen 3-pounder and 1-pounder Q.F. guns, with two under-water torpedo-tubes. The other vessels to be built by contract are two torpedo-avisos "M3" and "m1" the first of which is to be a vessel of a new type of about 700 tons displacement, with engines to develop 6,400-I.H.P. under forced draught, giving a speed of 22·5 knots, the armament to consist of six 6-pounder and six 3-pounder Q.F. guns; "m1" is to be only of 375 tons, but she is to have a speed of 26 knots, her armament consisting of one 6-pounder and seven 3-pounder Q.F. guns and one torpedo-tube; a torpilleur-de-haute-mer "N12" of larger dimensions than those previously built is also to be constructed, she will have a displacement of 240 tons, a speed of 24 knots, and a radius of action of 1,000 miles; two first class torpedo-boats "P25" and "P26" are also to be built, and a gunboat "T2."

The ships to be built in the Government yards are to be a first class cruiser "C2" at Toulon, a second class cruiser "E5" at Cherbourg, a third class cruiser "K3" at Rochefort, and an aviso "S3" at Toulon.

The plans of the two third class cruisers to be commenced this year have now been approved; they are to be named the "d'Estrées" and "Infernet," and will have a displacement of 2,000 tons, with a length of 265 feet 6 inches, a beam of 37 feet 6 inches, and a draught of 16 feet. The engines will develop 4,200-I.H.P., and the boilers will be of the Allest water-tube pattern; the speed to be 17 knots, with a radius of action of 5,000 miles at 10 knots. The armament will consist of four 12-centimetre (4·7-inch) Q.F., six 6-pounder Q.F. and six 1-pounder Q.F. guns. There will altogether be under construction, fitting out, or on trial during 1896, 60 ships, divided as follows:—9 battle-ships; 3 coast-defence battle-ships; 2 corsaire-croiseurs; 5 first class cruisers; 9 second class cruisers; 5 third class cruisers; 1 torpedo-cruiser; 2 avisos; 1 torpedo-depôt ship; 2 torpedo-boat destroyers; 2 gun-boats; 1 torpedo-aviso; 5 torpilleurs-de-haute-mer; 7 first class torpedo-boats; 5 second class boats; and one submarine boat.—*Le Moniteur de la Flotte*, *Le Temps*, and *Annexe No. 6 du Projet de Loi (Budget des Dépenses du Ministère de la Marine).*

GERMANY.—The following are the principal promotions and appointments which have been made: Vice-Admiral—von Reiche placed on retired list. Rear-Admiral—Thomsen to be Vice-Admiral and appointed to command of the Baltic Station. Kapitäns zur See—H.R.H. Prince Henry of Prussia, and von Arnim, to be Rear-Admirals. Korvetten-Kapitän—Sarnow to be Kapitän zur See. Rear-Admirals—von Arnim to command of 2nd Division of Manœuvre Squadron; von Diederichs to Chief of the Staff at the Ministry of Marine; Barandon to Inspector of the 1st Marine-Inspection; Oldekop to Director of Naval Instruction. Kapitäns zur See—Freiherr von Bodenhausen to "Hohenzollern"; Kirchhoff to "Wörth"; von Frantzius to "Weissenburg"; Wodrig to "Brandenburg"; Graf von Baudissin to "Kurfürst Friedrich Wilhelm"; Geissler to Chief of the Staff of Manœuvre Squadron; Oscar von Schuckmann to Chief of the Staff of the North-Sea Division; Lavaud to "Baiern"; August Thiele to "Stosch"; Boeters to Inspector of Marine Artillery; Oelrichs to command of 2nd Dockyard Division; Fritze to Chief of the Staff of Baltic Division; von Rittmeyer to 1st Dockyard Division; and Hofmeier to command of 1st Seamen's Division.—*Marine Verordnungsblatt.*

Admiral Knorr, the Commanding Admiral of the German Navy, hoisted his flag on board the "Mars" at the end of August, and assumed supreme command of the whole fleet assembled for the Grand Manœuvres. The fleet

consisted of the two divisions of the Manœuvre Squadron, under Vice-Admiral Koester and Rear-Admiral Barandon; the squadron formed of the four sea-going training-frigates under Rear-Admiral von Diederichs; a squadron formed of four of the new coast-defence battle-ships of the "Siegfried" class, under Rear-Admiral Oldekop, one or two vessels commissioned for special duties and a torpedo-flotilla, consisting of two divisions of twelve boats each and a torpedo-aviso. Admiral Knorr had altogether twenty-six ships under his command, without counting the torpedo-boats, twelve of which were battle-ships. Steam tactics and attacks on the fleet by the torpedo-boats were carried on constantly during the time the squadron was at sea. There is one unfortunate and serious mishap to record, namely, the capsizing of torpedo-boat "S 41," with the loss of thirteen men of her crew. The squadron was *en route* from Wilhelmshaven to Kiel; on the morning of the 28th August very bad weather set in with a heavy sea. While off the north-west coast of Jutland and steaming for shelter towards the land, "S 41" was struck by a heavy sea, capsized, and went down. The officer in command, Lieutenant Langemack, a quartermaster, and one man were all who were saved, and were rescued by the Division-boat "D 4." On the morning of Friday, the 13th ult., the Kaiser joined the fleet off Danzig in his yacht the "Hohenzollern," and accompanied the fleet to sea, the day being spent in steam tactics. The next morning the Kaiser embarked on board the "Mars," Admiral Knorr's flag-ship, and the squadron again put to sea under his orders, the manœuvres being brought to a close in the evening, and the Kaiser hauling his standard down from the "Hohenzollern" and leaving for Berlin on Monday morning. The 1st Division of the Manœuvre Fleet is to winter at Wilhelmshaven, where they have already arrived, having passed through the Baltic and North Sea Canal, experiencing no difficulties or delays *en route*.

Last year the Kaiser presented a silver cup, to be held by the commander of the ship of the Manœuvre Squadron, which made the best heavy-gun shooting at the general target practice of the fleet; it was then won by the "Sachsen," commanded by Prince Henry; this year it has gone to the "Baiern," Captain Kirchhoff, which scored nine hits out of the ten rounds fired at the target.

The four sea-going training-ships have left for their winter cruise; the cadet-ship "Stosch" and the boys' training-ship "Moltke" proceeding to the West Indies, and the cadet-ship "Stein" and the other boys' training-ship "Gneisenau" going to the Mediterranean.

The battle-ship "Baiern" has been ordered to Danzig, where she will undergo a thorough repair at the Schickau Yard, receiving new boilers, guns, and being fitted with military masts.

The plans for the four cruisers approved to be built by the Reichstag have now been passed by the Minister of Marine. The armoured cruiser *Ersatz* "Leipsig" is to be built at the Imperial dockyard at Kiel; one of the three other cruisers is to be built at Danzig, the engines and boilers, however, being constructed by the Germania yard at Kiel; one is to be built by contract at Bremen, and the other by the Vulcan Company at Stettin. The new fourth class battle-ship "Ægir" is being supplied with water-tube boilers, as also the torpedo-aviso "Greif" which is undergoing a thorough overhaul and repair; and all the four new cruisers are to be supplied with them.

The triple-screw cruiser "Kaiserin Augusta" has made her trial trip after a complete repair of her machinery; with her mid-ships screw alone she made an average of 15 knots.

It is reported as one of the results of some of the operations carried out by the fleet during the early part of the manœuvres against the coast defences, that the fortifications at the mouth of the Elbe and protecting the approach to the new canal are to be much strengthened.—*Neue Preussische Kreuz Zeitung.*

RUSSIA.—The new armoured-cruiser "Rurik" (see frontispiece) has at last been completed, and is said to be about to proceed to reinforce the Russian squadron in the Mediterranean under Rear-Admiral Makarof. The "Rurik" was launched from the Baltic Company's yard at St. Petersburg in the summer of 1892, and her dimensions are as follows:—Length between perpendiculars, 410 feet 6 inches; over-all, 433 feet 6 inches; beam, 66 feet 6 inches; mean draught, 25 feet 3 inches; displacement, 10,933 tons; normal coal stowage, 1,660 tons; extreme, 2,000 tons; engines, I.H.P., 13,250. Protection is afforded by a water-line armour-belt of 10-inch compound armour, which is seven-eighths the length of the ship with a depth of 7 feet, 3 feet above and 4 feet below the water at normal draught; there is also a steel-armour deck 2·5 inches thick. The armament consists of four 20·3-centimetre (8-inch) Obuchoff B.L. guns, two forward and two aft in armoured sponsons; sixteen 6-inch Q.F. guns in sponsons on the broadside on the main deck; six 5-inch Q.F. guns on the upper deck and eighteen smaller Q.F. guns with five torpedo-discharges. The ammunition tubes are also protected by 4-inch steel armour. The boilers are half of the Belleville water-tube type, and the remainder double-ended cylindrical. The eight boilers are made of Martin's steel, and are in four compartments. At the measured-mile trials the ship made an average of 18·7, the highest speed obtained being 19·3, the engines making 82 revolutions with 13,558-I.H.P., or 338 over the contract, without the use of forced draught; at this speed there was little or no perceptible vibration. At 10-knot speed the ship has a steaming radius of 20,000 miles, which will enable her to proceed from the Baltic to Vladivostock without recoaling. The "Rossia," the improved "Rurik," now under construction, is to have triple-screws, and all her boilers will be of the Belleville water-tube type.—*Mittheilungen aus dem Gebiete des Seewesens nach Kronstadtski Waestnik.*

The first consignment of armour plates for the new battle-ships "Poltava" and "Petropawlosk" have reached St. Petersburg from the United States, where they have been forged by the Bethlehem Iron Company. The plates vary in thickness from 16 inches to 7 inches.

The new coast-defence battle-ship "General-Admiral Apraxin" is to have engines developing 5,000-I.H.P., which with natural draught are to give the ship a speed of 14 knots, and with forced draught 16 knots; the normal coal supply will be 215 tons, giving a steaming radius at 10 knots speed of 1,600 miles. The armour protection consists of a belt of armour 177 feet long, with a depth of 7 feet, 10 inches thick amidships, and tapering to 8 inches forward and aft, with two armoured athwartships bulkheads, the foremost one being 8 inches and the after one 6 inches thick. The two turrets will have 8-inch armour, and the armoured deck will be 3 inches thick tapering to 2·5 inches. The armament will consist of four 23-centimetre (9·2-inch) guns in the turrets; four 15-centimetre (5·9-inch) Q.F. Canet guns at the four corners of a central redoubt; six 6-pounder and eight 1·5-pounder Q.F. guns, with four 1.5-pounders in the tops; and there will be four torpedo-tubes, one forward, one aft, and one on each broadside.

In Nicolaieff the construction of the new battle-ship "Rostislaw" is being now pushed on. Her dimensions will be as follows:—Length, 344 feet 6 inches; beam, 66 feet 6 inches; displacement, 8,880 tons; mean draught, 23 feet 6 inches. There will be sixteen boilers, and the engines are to develop 8,500-I.H.P. under forced draught, which will give the ship a speed of 16 knots. Over four-fifths of her length the "Rostislaw" will have a waterline belt, 7 feet deep, 16 inches thick amidships, tapering to 12 inches at the ends; above the belt will be a central redoubt, protected with 5-inch armour. The armament will consist of four 12-inch guns mounted in pairs in turrets protected with 12-inch armour, tapering in rear to 10 inches; six 6-inch Q.F. guns in the central battery, and sixteen 3-pounder and 1·5-pounder Q.F. guns, with six torpedo-tubes, one forward,

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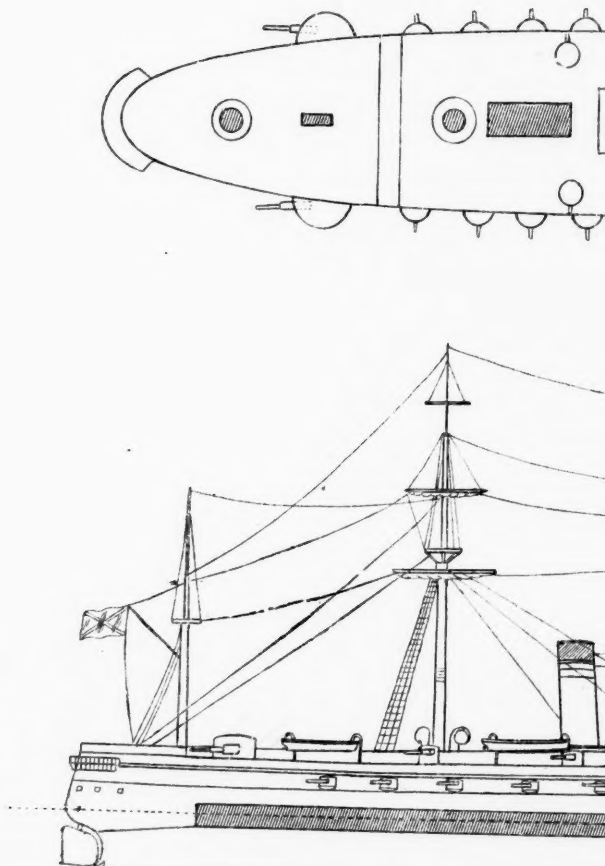

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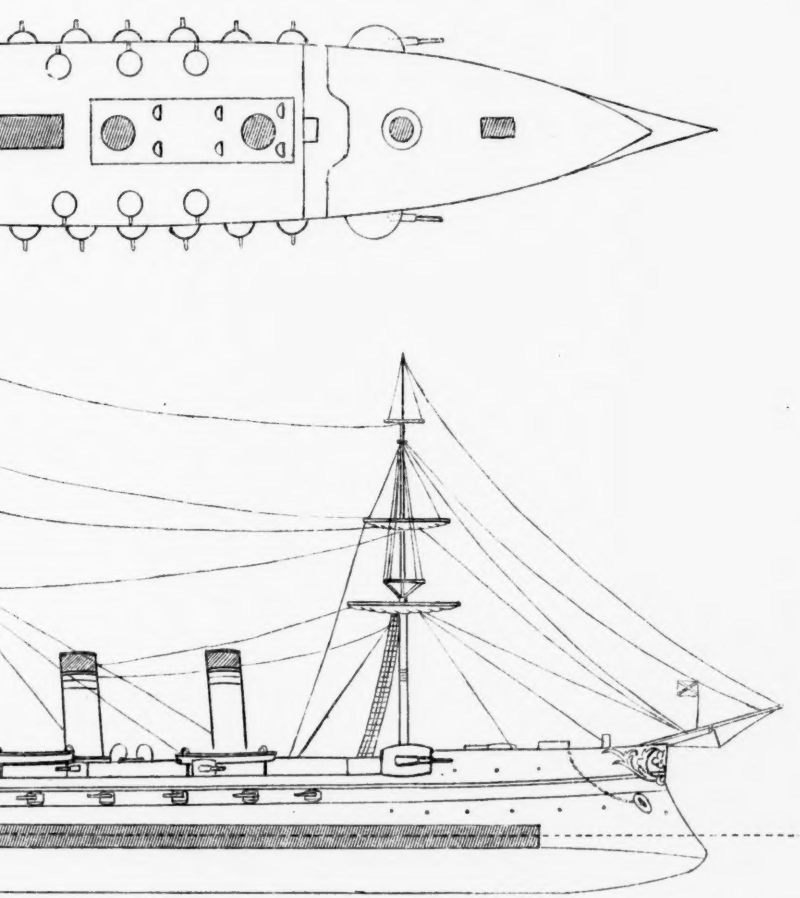


PLAN AND PROFILE OF "RURIK."

one aft, and two on each broadside. The armoured deck will be 3 inches thick, tapering to 2 inches, and the furnaces will be fitted to burn petroleum fuel.—*Mittheilungen aus dem Gebiete des Seewesens.*

The new torpedo-boat destroyer "Sokol," built and engined by Messrs. Yarrow and Co., of Poplar, underwent her official speed trials at the mouth of the Thames last month. The vessel, which had previously been brought down the river to Gravesend, left the town pier at 11 a.m., and proceeded under easy steam to the Lower Hope, whence her speed was gradually increased so that by the time the Maplin measured mile was reached it should be at the full. There the following programme of running, which had been previously arranged, was carried out. Three runs, down, up, and down the mile, were first made. These were followed by a continuous two-and-a-quarter hours' full-speed run, commencing at the end of the third completed mile, and so arranged that at the expiration of the given time the vessel should have returned to the mile end last left. Thence three runs over the mile were again made, and at their completion the vessel was headed up the river. The mean speeds and revolutions of the two sets of three-mile runs were then used as a basis to calculate the mean speed attained during the two-and-a-quarter hours' run from the number of revolutions made by the engines in that time. The vessel went on the first mile at 12.18 p.m., and came off the sixth mile at 3.17 p.m., having in the meantime accomplished the six runs and done the stipulated two-and-a-quarter hours' work in running to the Sunk Lightship and back again to the measured mile. The resulting mean speeds attained by the vessel in knots per hour and revolutions of the engines per minute in the runs on the mile were as shown in the following table:—

—	Speed in knots.	Mean speed.	Revolutions per minute.	Mean revolutions.
First three runs ...	29·445	29·773	398·8	405·05
Last three runs ...	30·102		411·3	

similar mean results being obtained for the work done during the two-and-a-quarter hours' running of the vessel when off the mile. The mean air pressure in the stokeholds during the mile runs was equal to 1·12 inches of water, and the highest registered during the two-and-a-quarter hours' run never exceeded 1⅜ inches. The mean I.H.P. developed by the engines during the trials was 3,700, obtained with steam of 160 lbs. pressure per square inch in the boilers. The "Sokol" is a similar type of vessel to H.M.S. "Havock" and "Hornet," but is larger than either, being 190 feet in length. She is also faster to the extent of about three knots, and is the first vessel that has actually attained a speed of 30 knots. Her hull, which, in form, is somewhat finer than that of the "Havock" or "Hornet," is constructed of nickel steel, a material of greater strength than that in ordinary use for such vessels, but aluminium has been largely introduced in places where great strength is not of primary importance. The propelling machinery and boilers are very similar to the "Hornet's," but greatly improved in numerous minor details, which collectively form an important element in the speed attained by this vessel, and it is to these details that the success of the "Sokol" is mainly attributable. The engines, which are capable of developing upwards of 4,400-I.H.P., and in the construction of which bronze has been freely used (combining as it does strength with lightness), are of the triple-expansion twin-screw type, and the boilers are Yarrow's patent straight water-tube ones with steel tubes. The arrangement of the space forward, below the deck, is similar to that usually adopted in the British Navy, that part of the vessel being appropriated to the crew, but in the after part abaft the engine-room there is a distinct departure from British practice, the accommodation for the officers being a decided improvement

on that of the "Havock" and "Hornet," the alteration in this respect having been determined by the Russian naval authorities. The armament of the "Sokol" consists of one 12-pounder Q.F. gun on the steering tower forward, and three 6-pounder similar guns on deck. There are also two swivel deck torpedo-tubes, for firing 16-inch torpedoes over either beam, but no bow tube, as it is now generally discarded. The coal-carrying capacity is 60 tons which, is sufficient to steam across the Atlantic at the rate of 10 knots. The trials of the vessel, which were highly successful, were attended by a Russian commission of naval experts, presided over by Prince Ouckhtompsky (Naval Attaché), and including, among others, Mr. Posetchkin (engineer inspector), Captain Behr, and Mr. P. A. Kraatz (the future commander and chief engineer of the ship). Mr. Crohn and Mr. Marriner, of Messrs. Yarrow's establishment, had special charge of the trials.—*Times.*

MILITARY.

HOME.—*Mobilisation of the 1st Brigade, 1st Division, 1st Army Corps.*—The report on the mobilisation of the 1st Brigade, 1st Division, 1st Army Corps, is most interesting, and fully confirms the favourable impression recorded in these pages at the time. The most interesting points are precisely those which it would not be discreet to publish, and the remainder have been so fully dealt with in the military weeklies that it is unnecessary here to recapitulate them.

Aldershot.—Field Firing.—In the field firing of the 2nd Infantry Brigade, 17th September, 14·97 per cent. of hits were obtained. The brigade turned out 1,680 rifles and the targets represented 733 men and 6 guns in position. The 3rd Brigade under similar conditions obtained a percentage of 12·78. The cavalry brigade made 11·33 per cent.

Cavalry Manœuvres.—Baron Salvi, well known on the Continent as a competent critic of cavalry matters, has contributed to No. 81 of the *Militair-Wochenblatt* a very eulogistic account of the recent drills and operations around Aldershot, from which the following extracts are taken :—

"To-day's manœuvres were held in very difficult and hilly country, deep ravines made it almost impassable in places, and heavy dust clouds interfered both with sight and the movement of the horses ; nevertheless galloped easily over these obstacles, moving as on a level parade. . . . . The Inspector-General of Cavalry is well known for the excellent results he has achieved in re-organising the cavalry, both Native and British, in India in conformity with the principles now everywhere prevailing on the Continent. . . . .

"The horses throughout are good, uniform in height and make, shew much breeding, gallop well and evince satisfactory staying power. . . . .

"In the execution of the manœuvres I noticed particularly the steadiness and precision of the movements even at the most rapid paces, the correct maintenance of direction and intervals and the accuracy with which the reserves maintained the proper distances."

VOLUNTEER CYCLIST INFANTRY LONG-DISTANCE CHALLENGE CUP.

The following account of this most interesting competition is taken from the *Volunteer Service Gazette*, 31st August, of this year. The essential points in the rules were :—"The teams consist of five *bonâ fide* members of Cyclist Infantry sections. They must cover a distance of about 100 miles (in this case, 101 miles). They must ride in military formation, and must carry military equip-

ment to the extent of rifle, bayonet, pouch and belt, cape, waterbottle, and haversack, besides being in the authorised uniform of their cyclist section. Tactically, the competition may be said to represent the seizing of a distant point by a forced march. . . . . . .

"On the same principle as in the last two years, a central point—namely, Maxwelltown (a suburb of Dumfries)—was selected. From this point four roads radiate to the following towns at the following distances: Thornhill, 14 miles; Springholm, 11½ miles; Dalbeattie, 13 miles; Kirkbean, 12 miles. It will be at once seen that anyone starting from Maxwelltown and riding these radiating roads in succession, returning each time to the starting point, will have ridden exactly 101 miles. Checkers are of course placed at the point of each radius, to see that each team rides out the distance. The advantages of this system are great. In the first place, the umpires can remain at one point, which is both start and finish, and through which each team passes, in addition, three times, thus being able five times to observe the condition of the teams. In the second place, four teams can be started at once, each along a different road, thus avoiding racing and mutual interference. In the third place, it eliminates as far as possible the differences in assistance or retardation from wind.

"The committee, consisting of Major-General Henry Stracey and Lieut.-Colonels A. R. Savile and E. J. A. Balfour, acted as umpires. The following were the results:—

	H.	M.	S.
1st V.B. Royal Fusiliers, 1st team	6	35	21
3rd V.B. Northumberland Fusiliers	6	36	25
Galloway Rifles (holders) 1st team	7	3	45
1st V.B. Royal Fusiliers, 2nd team	7	6	5
26th Middlesex (Cyclists) R.V., B Troop	7	15	50

"The following teams did not finish:—

"6th V.B. Liverpool Regiment, owing to delay caused by a broken chain at a distance from any cycle repairer's.

"The 4th V.B. Norfolk Regiment, owing to punctured tyres.

"The Queen's Edinburgh R.V.C., and the 2nd team Galloway R.V.C. for physical reasons.

"Now it must first be observed that the running of the two winning teams this year was at the rate of about 15½ miles an hour, as against about 12½ miles an hour by the winning team last year—an enormous increase of speed. This may be put down chiefly to the fact that the roads were in good order in 1895, whereas in 1894 they were literally seas of mud. But it is also to be noted that the winning team this year rode two tandems and a single, whereas last year they rode singles only. In any case, the performances of all the first five, and especially of the first two, were very fine.

"Looking at these results from a military, as opposed to a purely racing point of view, one's thoughts on endurance naturally separate in their relations to the rider and his mount. Considering the pace aimed at, and necessary to win, in such a competition, it would be astonishing if there were not, out of the forty-five competing, one or two who were unfit to finish; and if one man fails in a team the team is disqualified. Two teams were thus 'put out of action' by one man each. Another point, however, is worth noting. Although the 26th Middlesex only came in fifth, they finished in splendid condition. They were fit to use their rifles against an enemy, had there been one. This could not have been said of all the members of the other teams. . . . . .

"But equally important with physical endurance is machine endurance. This year, as last, the chief accidents which either delayed or stopped the teams were due either to punctured tyres or broken chains. The two teams of the Galloways, for instance, had ten punctured tyres. The 6th V.B Liverpool were arrested in mid career by a broken chain. Last year the accidents were far more numerous,

owing to the state of the roads; and the proportion of broken chains, owing to the absence of gear cases and weak chains, was enormous. But even with this year's great improvement the lesson has not been completely learnt. And it is one of the great uses of this competition to bring before both Volunteer cyclists and the manufacturers the fact that, unless a machine can be relied on to stand such strains as this with *certainty,* it is useless for military purposes. The winning team had no punctures and no broken chains; but they had Dunlop tyres *specially prepared for military purposes,* and they had chain guards."

THE HUNGARIAN CAVALRY MANŒUVRES.

AUSTRIA-HUNGARY.—Of all the manœuvres held this autumn in Europe the most interesting, from a cavalry point of view, have been undoubtedly those which have just been brought to a close, in the presence of the Emperor and the chief members of the Army Staff, near Kis Czell and Zenta.

At the former place a cavalry force, larger than any before assembled during peace in Europe, consisting of seventy-two squadrons with forty-eight horse artillery guns, divided into two bodies, which started some 130 miles apart, performed extended reconnaissances, culminating in the discovery of their respective whereabouts and in an action of the most brilliant description on the 18th ult. The average march of the more concentrated bodies was about 40 miles daily, while some advanced patrols are said to have covered 80 miles in the 24 hours. An officer of Hussars told the writer that he rode 60 miles on the 18th ult. The Honved, or Hungarian reserve, division marched 56 miles on that day, arriving in time to fall on the flank of the enemy during the action.

The efficient appearance of both men and horses at the close of these trying manœuvres was most remarkable. The horses looked in excellent condition, in spite of the weight carried so long daily, and casualties were practically non-existent. The reasons for this are very instructive. The daily work is gradually extended at the commencement of the drill season until the horses become fit and their backs hard. The men are never changed from one horse to another in the squadrons, as they have, unfortunately, to be in ours on account of the disproportionate numbers of men and horses. The man thus looks on his horse as his own property, spares him when he can, and cares for him as a friend. The men are dismounted whenever possible, and girths are loosed and backs cooled by slightly lifting the saddle. The saddles are so made that they allow of a free current of air between them and the blanket on the back, and kits are put on so as not to hinder this. It is possible to see the whole way under the saddle from cantle to withers. No horse under six years old accompanies the squadron to manœuvres. Finally, and most important of all, the pace of the march is an almost constant slow trot, with occasional halts, but with a *minimum* of walking. To this fact was attributed, by a senior Hungarian cavalry officer, in conversation with the writer at these manœuvres, the almost complete immunity from sore backs and galls; and any of our own cavalry officers of any marching experience will, no doubt, agree with him.

A cavalry regiment in Hungary is a splendid command, consisting of six squadrons of about 150 men and horses, a pioneer *zug* or troop of twenty-five men and horses, and a cadre, or depôt, left behind for recruits and remounts. The men are fine muscular fellows, the horses one might say perfect, each one a picture of a medium-weight, well-bred hunter. With such material and an ideal country over which to work, the Hungarian cavalry is the most perfect arm the writer has ever seen, with officers, men and horses fit for any duty. The formations adopted in manœuvre were observed to be of the simplest. These were carried out quickly and with precision. The handling of the three lines in the attack was skilful, while

the action of the horse artillery also showed that the subject had received particular care. It may be said that these manœuvres were a complete success, and went to prove that the Austro-Hungarian cavalry is in a very efficient state.

The second phase of the manœuvres consisted of a series of most interesting experiments in various appliances and means for the passage of rivers by cavalry and horse artillery, carried out, near Zenta, on the 20th and 21st ult. The General Idea was that an advanced brigade of cavalry, with its two batteries of horse artillery, had pushed forward from the south-east and had endeavoured to cross the Theiss river near Czeged. The enemy's advanced cavalry having prevented this passage, the brigade retreated south and prepared to cross at three points. At Zenta, the chief point of passage, a squadron of the 15th Hussars and the pioneer troop of the same regiment arrived at the river bank early on the morning of the 20th. After trying the nature of the banks and bottom in various places, the point of passage being decided upon, a man was sent across, stripped and with an air belt around him, to make similar trials on the right bank. The river here—some 1½ miles below Zenta—is 300 yards wide and perhaps 30 feet deep in mid-stream. The left bank was favourable for preparations, as it commanded the right slightly, with a belt of trees and bushes to conceal the horses, and a gradually shelving shore upon which to construct rafts, etc. A country cart, carrying the materials, having come up, a wooden-framed, canvas-covered boat was constructed, and within an hour of their arrival the party had some of their saddlery and men across. Rafts were also constructed with waterproof corn sacks filled with straw and lashed together on planks. On these some ten men and saddles were crossed at a time in about ten minutes. Other means also were tried, inflated bladders tied behind the armpits appearing to be very useful to assist the men in crossing. But the most interesting sight was that presented by the passage of the horses. These, driven into the water in droves by troops, and given a lead by a man, stripped, riding the foremost, or held by the bridle along the rafts or boats, swam across the broad river without the slightest exertion. Only in a few cases did they turn back, this being caused generally by the man leaving the leading horse too soon. Within three hours the squadron was across and mounted on the other bank, with a field telegraph station established to send messages across from the reconnaissance as it pushed on.

An interesting incident occurred during the operation. The scouts of the Honved cavalry having discovered the place of passage, the three squadrons were soon on the spot, and executed a brilliant charge against the dismounted men and led horses of the half-crossed squadron. As the Honveds consist entirely of reserve men, riding horses which are only partly broken for cavalry purposes and which are given out by the Government to the country people for their use in return for their feeding and care, their action was of more than ordinary interest. The charge was delivered in excellent order, with supports and reserve, and when wheeling about again the troops appeared to move handily and steadily. The horses looked well, bright in the coat, and fit, yet well covered with flesh, showing that the system is a successful one.

The following morning the whole brigade and the twelve horse artillery guns crossed at the same spot and with the same appliances, supplemented by some new experimental rafts, for the passage of guns and limbers, formed from collapsible Berthon boats and zinc portable pontoons. It was a wonderful sight to see the horses—nearly 2,000 in number—swim across this broad river in droves, accompanied by men in boats or on rafts, and land safely on the opposite side without a single casualty. The operation lasted some 3½ hours. It may be observed that the manœuvre gave a splendid opportunity for seeing the horses' backs as they filed past one, below, to the water's edge, and they were all in perfect condition and almost free from any sign of blemish. The condition of the horses was in every way excellent.—*Times*, October 3rd.

High Explosives for Field Guns.—The budget for 1896 contains a special credit for the manufacture of high explosive shells. The explosive used is "Ecrasite," and fifteen rounds per gun are allotted to the field artillery.

GERMANY.—*The German Manœuvres.*—The conviction that the attack is the surest road to success permeates the German regulations, and has taken firm hold of the minds of both officers and men. The principles of both strategy and tactics are freely and constantly discussed in the army; but it is rare indeed to hear defensive tactics alluded to except as a procedure which is sometimes unavoidable. The deliberate occupation of a position with a view to repulsing the enemy's assault, and of then crushing his decimated and exhausted masses by a general advance, is seldom advocated. On this point, amongst English soldiers, opinions differ. On our roll of victories are recorded some few defensive battles, amongst which is Waterloo; and these few, or possibly Waterloo alone, appear to exercise more influence on tactical thought than all the remainder, from Blenheim to Tel-el-Kebir. Moreover, in discussing tactical questions, the mechanical bent of the English mind asserts itself. Every improvement in fire-arms appeals to the curiosity of the public. The details of their construction are investigated with intelligent attention; the effects that may be expected from them, foreshadowed by the tests of the practice range, are an attractive subject of speculation, and it is often tacitly assumed that the weapon is of more importance than the man, and armament a matter of more moment than *moral.* The German attitude is diametrically opposite. Their soldiers are not in the least inclined to under-rate the effects of modern fire. But they are by no means inclined to pin their faith on the experiences of the butts, and, believing that human nature remains the chief factor in war, they still, notwithstanding the death-dealing properties of modern ordnance, adhere consistently to the offensive.

I spoke in my last letter of some of the marches executed by the German troops in the war of 1870-71, and of the arduous tasks demanded from their successors at the manœuvres. In Pomerania the marches were not so long, or, with one exception, so severe as usual. The operations, properly so called, lasted four days—from the 9th to the 12th of September. Previous to and after that time the troops were not moved under conditions of war. The average length of the daily marches for the first three days was as follows:—9th September—Northern Army: 9th Corps, 22 miles; 2nd Corps, 12 miles; Cavalry Division, 25 miles and an engagement. Southern Army: Guard, 16 miles; 3rd Corps, 16 miles; Cavalry Division, 20 miles and an engagement. 10th September—Northern Army: 9th Corps, 18 miles and battle; 2nd Corps, 8 miles and battle. Southern Army: Guard, 13 miles and battle; 3rd Corps, 12 miles and battle. 11th September—Northern Army: 9th Corps, 11 miles and battle; 2nd Corps, 12 miles and battle. Southern Army: Guard, 12 miles and battle; 3rd Corps, 10 miles and battle. On the last day of the manœuvres it was impossible to ascertain the distances covered by the troops. The movements during the action which took place were not protracted, and during the night the opposing forces had bivouacked in close contact. But when the "cease fire" sounded, about 11.30, the infantry at once marched off to the stations at which they were to entrain. By 2.30 I saw some of the battalions at least 10 miles from the field of battle; and the work on this day, in many instances, was certainly more severe than on any day previous.

The above shows the average length of march, calculated from the official maps, which, issued every evening to the Umpire Staff and Military Attachés, give the halting places of the troops for the night; but many more miles, on each day, were covered by individual brigades and regiments. When I add that the roads in Pomerania, with the exception of the few highways, are of the worst possible description, unmetalled and deep in sand, and that during the battles the

troops were called upon to cross a long succession of ploughed ridges, which broke up into stifling dust, it will be seen that the marches of the manœuvres bore a most warlike aspect. In one instance the men were unduly taxed. On the morning of September 9th a portion of the 9th Corps was asked to do from 13 to 16 miles in something under five hours. The greater part of them arrived upon the scene, came into action, and defeated the enemy opposed to them. It was adjudged by the umpires, however, that they were not in a fit condition to follow up their success. As a matter of fact a good many men—150, I believe, in all—had fallen out; and as his officers take good care that no German soldier leaves the ranks without sufficient cause, there can be no question but that a number of the men were utterly exhausted. I have reason to believe that most of the casualties occurred in the 4th Battalion, composed of "employed men" and reservists; and a forced march on the first day of the manœuvres, under a hot sun, was doubtless too much to ask from these comparatively untrained men. But, nevertheless, although the rest of the men were able to fight and win a hot engagement, and then march four or five miles to their bivouacs, the decision of the umpires shows that they were only kept up to their work by force of *esprit de corps* and discipline. It would be unfair not to add that the tactical situation, in the opinion of the corps commander, imperatively demanded the utmost rapidity of movement, and that, despite his losses on the march, he succeeded in accomplishing his immediate object—*i.e.*, the defeat of a somewhat isolated division of the Southern Army. Save in this one instance the casualties on the march were few and far between. Practically speaking, with the exception of a few who succumbed to heat apoplexy, there were no stragglers; men who had had enough of it long before they reached their bivouacs struggled on with the colours to the end; and, taken as a whole, the troops marched magnificently. Even when marching into camp the ranks were as well closed up as when they left it; the sections of fours maintained their distances with absolute exactness; few men looked distressed; and the best proof of their marching powers was that the officers and non-commissioned officers had no need to urge them on. If it is not hurried forward at an unusual pace, as was the case with the 9th Corps, the march of a German regiment resembles the movement of a machine; when once set in motion not another word is required until it is to halt. No officer or non-commissioned officer need open his mouth. Nor can it be said that the clothing and equipment of the men are calculated to make marching easy. The weight carried by every soldier is considerable. The cowhide knapsack and its contents weigh about 12 lbs. The greatcoat, mess tin, tent equipment, rifle pouches, and belts bring the total to over 40 lbs., and, without ammunition, but including clothing, the weight carried by the infantry, whether in war or at the manœuvres, is nearly 60 lbs. Nor is the cloth tunic, tightly buttoned, the model of a comfortable campaigning dress.

And yet, despite his heavy kit and his thick clothing, with a black stock round his neck, and his trousers tucked into his long boots, the German soldier not only does his 15 miles a day with comparative ease, but, if the pace is not forced, he can cover five-and-twenty and not break the ranks. It is true that his performances are nothing extraordinary. He is not a better marcher than his neighbours. French and Russians make just as light of heavy burdens and bad roads; Austrians and Hungarians are not a whit less sturdy and enduring. Nor does he surpass the soldiers of the old campaigns. I have already referred to some of the historic marches of 1870; and, to go still further back, the history of the Peninsular War tells us that hardy soldiers are no mere product of scientific training. The following diary of marches, taken from the regimental records of the Royal Fusiliers, bears witness to the discipline and muscles of Wellington's veterans. In April, 1811, the 1st Battalion marched 176 miles in eleven days, including one rest day, the longest day's march being 28 miles. In pursuit of Massena it covered 228 miles in twenty-one days, including five rest days.

In the advance to Vittoria and the pursuit after the great battle 402 miles were covered in forty-seven days, fighting took place on four days, there were ten rest days, and the longest march was 20 miles. In the expedition to Bordeaux, May, 1814, nineteen days sufficed for a march of 330 miles, with one rest day, the longest march was 26 miles, and on seven days the regiment made from 20 to 24.

It is no news, however, that the Imperial army has reached the very highest standard of mobility. But, as there are certainly people who do not fully understand the reason why so high a standard is demanded, there may be others who are ignorant of the methods by which it is attained. To explain these methods I may be permitted to quote from a writer who has had unrivalled opportunities of witnessing the training of the German soldier.

The boot worn by the soldier, as is well known, is a Wellington, and when marching the trousers are tucked inside. Socks are not worn, but a woollen rag, cut square, and folded over the foot according to the taste of the wearer.

"Between this excellent woollen rag," says Mr. Bigelow, "and the care taken regard to the selection of boots and shoes, so much has been achieved for the foot-gear of the soldier that it has now become axiomatic that any difficulty with a soldier's feet must be presumed to spring from a soldier's own carelessness. There are two things which the German officer does not and cannot condone—the one is non-efficiency of the soldier's rifle, the other a chafed foot. If either of these two takes place on the march or during the manœuvres, the soldier is immediately punished with arrest, and is not allowed to offer any excuse. During the different manœuvres of German Army Corps that I have attended, I can recall but a few cases of footsore men in the course of a day's work, and yet at all these field operations forced marches are a feature in order to test the endurance of officers and men. The secret of this uniform excellence, as regards marching powers, lies in the training which the men receive. When they enter their company as recruits in October, the first thing that is impressed upon their minds is the importance of the boot and the rifle. No pains are spared in giving the men at the start comfortable foot-gear, and they are expected to look after this with as much interest as if it were a chronometer. In the spring following, when the snow is off the ground, marches are undertaken, and these are regulated as carefully as are the strokes and the courses of the college crew under the hands of the trainer. Each day the men march half a mile or so further than the day before; each day they carry on their back an ounce or two more; each day the speed they are able to maintain is carefully noted; in fact, the record of a company's marching from day to day, until late in the summer, when they move into the open country, is kept as minutely as if it were a single picked company training for a match or competitive drill."

It will be noticed that the men always carry their packs when marching. As will be seen from what I have already said, the packs are not heavy in themselves—even when full; but the pack serves as a means of carrying the greatcoat, tent equipment, mess tin, and reserve ration; and these articles bring up the weight to some five-and-twenty pounds. Moreover, although the equipment, as it has not been altered for many years, probably rides as easily as any that can be devised, the straps and braces, despite the fact that none cross the heart, would become an intolerable nuisance to men unaccustomed to their pressure. Yet the German soldier carries his pack without the slightest inconvenience. The equipment is so adjusted as to be readily put on and off, but during the longest halts it is rare to see the men ease their shoulders of their burden. Habit has inured them to the weight, and the prevision of the military authorities very rightly insists that this habit should be early acquired. Every exercise, whether in the open country or on the barrack square, whether a parade for musketry, for aiming drill, for squad drill, or for a field day, is done in heavy marching order, with a graduated weight, in the case of recruits, carried in the pack. The German

soldier hardly knows what it is to parade without his full equipment, and his valise is the inseparable companion of his rifle. It is by this means that he is trained to bear the extra weight, and the good result becomes evident at the manœuvres. The practice has also a further aim. In case of war the battalions would each receive 500 reservists, men who have been absent from the colours for one, two, or even three years; and these men, with probably no time whatever for previous training, would take their places in the ranks and march against the enemy. The half of each battalion then would consist of men out of condition, in all likelihood untrained to marching, and certainly unaccustomed to the weight of the knapsack. It is considered, however, that if the soldier with the colours carries his full equipment every day of his service, habit will become a second nature; and that when he rejoins his shoulders will speedily become reconciled to the once familiar load. It has often been suggested, in order to increase mobility to the utmost, that the knapsacks should be carried on carts. On this point, however, there is no second opinion in Germany. In a forced march, or a series of forced marches, it may sometimes be advisable to relieve the men of every pound of weight not absolutely necessary. But, as a general rule, the absence of the necessaries carried in the knapsack adds very largely to the discomfort of the soldier.

In conclusion, I may point out that the decentralisation which is the mainspring of German efficiency is the real foundation of the marching powers of the individual soldier. The men, when they join as recruits, are twenty years of age, and their frames and muscles are those of men. But it is the company commanders who turn them into good marchers. The major (battalion commander) has very little to do with their training. During the first six months of their service the company commanders are entirely responsible; musketry, marching, drill, gymnastics, and education are in their hands. There is no programme laid down; no uniform method of training made obligatory, and the major has nothing more to do than to maintain a general supervision. As regards marching he may test the progress of the company in various ways—by inspecting the march diary, by accompanying the march, or by observing the men on their return to barracks. As a matter of fact, supervision or interference is rarely needed. The company commander is well aware if his men cannot shoot or cannot march that he has no hope of promotion; and the rivalry between different officers, each striving to make his own command the most efficient, is more than sufficient to prevent all slackness. And this system is based on common sense and on a due recognition of clearly-defined responsibilities. The major himself cannot directly train his men to march any more than he can train them to shoot. In training men to march, as in training them to shoot, the characteristics of the individual must be carefully considered. These characteristics cannot be known to the battalion commander. He knows his men *en bloc*, but not as individuals, and he has to treat them *en bloc*. With the company commander it is different. He is in constant contact with the men. His command is of such a size that he can learn the peculiarities of each man, and make allowances for them; and he has ample time to give special attention to every private in his company. Moreover, his future career depends upon the results he produces. He is in no way hampered. He is encouraged to employ his own method of training. No one interferes with him; but it is by the results that he is judged. It is to this decentralisation and to the practice which obtains of *training the men individually*, not by squads, that the German infantry owes the precision of its close order drill, its efficiency on outpost and reconnaissance, its skill in shooting, and its endurance on the march.—*Times*, October 3rd.

Experimental Field Railway.—The railway brigade has recently completed the following very important experiment. The object was to show what could be

done in point of speed by two war-strength companies (say 500 men), and to test the solidity of construction by the transport of siege artillery and stores.

The line started from the artillery practice ground at Zossen, and thence in the direction of Magdeburg to Loberg—total distance, 59 miles. The work was taken in hand from one end only, and the iron girders, etc., for the projected bridges collected in advance ; the gauge of the track was 25·5 inches.

During the first five days an average rate of progress of 6·2 miles a day was easily maintained ; and for the last three days, by working at night, 9·3 miles were satisfactorily laid.

JAPAN.—Special attention is called to Lieut.-Colonel Barrow's article in the *United Service Magazine* on "Military Japan after the War." An article in the *Contemporary* for this month, "The Constitutional Crisis in Japan," should be carefully read at the same time by all who wish to form a correct opinion as to the real fighting strength of Japan in a prolonged struggle. Any appreciation founded in ignorance of the internal tension existing in that Empire must necessarily be very misleading.

SWITZERLAND.—*Hebler Tubular Bullets.*—According to the *Revue Militaire de l'Étranger*, recent experiments in Switzerland, the United States, and Austria, with the Hebler bullet, have not justified the anticipations of its inventor. The bullet loses its velocity more rapidly than the solid one of the same bore, owing to the resistance of the air in its passage through the tube, and even at short ranges its accuracy leaves much to be desired.

FOREIGN PERIODICALS.

NAVAL.

AUSTRIA-HUNGARY.—*Mittheilungen aus dem Gebiete des Seewesens.* No. 10. Pola and Vienna : October, 1895.—" The Congress of Naval Architects at Paris." " The Progress in Armour and Naval Guns in 1894." " A Method of determining the Fighting Values of Ships." " The International Naval Review at Kiel." " The English second and third class Battle-ships." " Launch of the English cruiser 'Powerful' and first class French battle-ship 'Masséna.'" " The new United States Battle-ships." " Naval Foreign Chronicle." " The San-Blas Canal, a third project for connecting the Atlantic and Pacific Oceans." " Notices of Books."

BRAZIL.—In addition to the two battle-ships of 3,500 tons which are under construction at the " Forges et Chantiers de la Méditerranée," at La Seyne, the Government are about to construct the following vessels:—Three protected steel cruisers, which are to have their bottoms sheathed with wood and coppered, and will be of 4,000 tons displacement, with a speed of 19 knots under natural and 20 knots under forced draught; the coal supply is to give a steaming radius of 10,000 miles at 10 knots. Three torpedo-cruisers of 1,000 tons displacement to have a speed of 20 and 22 knots under natural and forced draught respectively, with a steaming radius of 3,000 miles at 10 knots; the armament will consist of two 10-centimetre (3·9 inches) Q.F. guns, and six 6-pounders Q.F. guns with three torpedo-tubes. Eight torpedo-boat destroyers, with a speed of 26 knots of the " Gustavo Sampaio" type, and six first class torpedo-boats. Finally, two submarine boats of the " Goubet" type have also been ordered; they will be 26 feet long, cigar-shaped, and be constructed of bronze, and are to be capable of remaining under water for 15 hours, oxygen being furnished by reservoirs and the vitiated air being pumped out; they will be driven by electric motors of 2-H.P., giving a speed of 8 knots, and the torpedoes can be detached automatically at any depth.—*Le Yacht* and *Moniteur de la Flotte.*

FRANCE.—*Revue Maritime et Coloniale.* Paris: August, 1895.—" Influence of Sea Power on History"; continued translation of Captain Mahan's book. " Remarks on a Phenomenon observed during the firing of Projectiles of high Initial Velocity." " *Résumé* on the opinions of the English Press on Modern Naval Tactics after the battle off the Yalu." " An Automatic Pointing Apparatus for guns mounted in Elevated Batteries." " Maladies of Seamen and Naval Epidemics." " Foreign Naval Chronicle." " The Maritime Fisheries." September, 1895.—" The Utility of a Methodical Re-organisation of the Naval Establishment." " The Sailors of the Guard (1803-1815)." " On the Stability of Small Vessels in a Heavy Sea." " Statistics of Shipwrecks and other Accidents at Sea for the year 1893." " A Study on the Law of Tempests." " Foreign Naval Chronicle." " The Maritime Fisheries."

Le Yacht. Paris: 7th September, 1895.—" Modern Naval Tactics" *(concluded).* " Yachting Notes" (with excellent reproduction of instantaneous photographs). " The English Regattas." " The Squadron of the North at St. Malo." " The Organisation of the Transport Service between France and Indo-China." " Naval Notes, Home and Foreign." 14th September—" Modern Naval Tactics." " Yachting Notes" (with plans and photographs). " The American Cup, 1895." " The English Regattas." " Approaching Launches of War-ships." " The Merchant Navies, with Statistics." " Naval Notes, Home

and Foreign." 21st September.—"The Method of Naval Recruiting in Italy." "Yachting Notes" (with photographs). "The American Cup, 1895." "Experiments to determine the form of least Resistance of a Hull." "Phonetic Indicator Signals." "Electric Logs and Sounding Machines." "Naval Notes, Home and Foreign." 28th September.—"The new 23-knot Cruisers." "Yachting Notes" (plans and photographs). "The Question of Auxiliary Transports." "Naval Notes, Home and Foreign." "Phonetic Indicator Signals."

Le Moniteur de la Flotte. Paris: 7th September, 1895.—"The Seamen of the Guard" (Marc Landry). "The Calling-out of the 1891 Class of Reserve." "Colonial Notes." "Naval Chronicle, Home and Foreign." "Official Announcements." 14th September.—"Preparation for War" (Marc Landry). "The Naval Manœuvres." "Colonial Notes." "Naval Chronicle, Home and Foreign." "Official Announcements." 21st September.—"The Organic Laws S.V.P." (Marc Landry). "Colonial Notes." "Naval Chronicle, Home and Foreign." "Official Announcements." 28th September. — "Submarine Cables" (Marc Landry). "The New Constructions." "Colonial Notes." "Naval Chronicle, Home and Foreign." "Official Announcements."

La Marine Française. Paris: 10th September.—"Maximum Speed and Sustained Sea-speed." "The Reform of the Naval Arsenals." "Retrospective Notes on Battle-ships" (with plan). "The Japanese Navy." "Naval Chronicle, Home and Foreign." "Notes on the Merchant Navies and Foreign Commerce." 25th September.—"Rochefort, a refitting port for the National Defences" (Admiral Coulombeaud). "The Reform of the Naval Arsenals" *(concluded).* "The Grand English Naval Manœuvres." "Yachting." "Naval and Commercial Questions." "The Merchant Navies and Foreign Commerce."

GERMANY.—*Marine Rundschau.* Berlin: October, 1895.—"The necessity for a regular system of Athletic Training for Naval Officers, and some proposals for carrying it out." "Some remarks on the article 'Naval Officers and Foreign Languages.'" "The use of Sound Signals for denoting the course of Ships in Fogs." "The High-Seas Herring Fisheries." "The use of Electricity on board the new mail steamer 'St. Louis.'" "Foreign Naval Notes." "Notices of Books."

ITALY.—*Rivista Marittima.* Rome: August and September, 1895.—"Side by Side," by our special correspondent at Portsmouth, on the visit of the Italian Fleet, July 1895. "The mechanical application of Electricity to Ships of War." "A contribution to the Rational Solution of the Ballistic Problem." "The drafting of the Statutes for our Merchant Navy." "The Naval Situation in the Mediterranean" (*continued*). Letters to the Director:—"The Attempt to occupy Famagusta by Ferdinand di Medici in 1607"; "The new 'Valkyrie' and 'Defender'"; "The General History of the Navy." "Naval Chronicle, Home and Foreign." "The Mercantile Navy." "Notices of Books."

RUSSIA.—*Morskoi Sbornik.* St. Petersburg: August, 1895.—"The Regulations for the Diving School." "The Air-Pumps in Ships' Engines."

SPAIN.—*Revista General de Marina.* Madrid: September, 1895.—"Retrospect of last year." "More Remarks on the Belleville Boilers." "Increase in Displacement in Battle-ships." "Elementary Electro-dynamics." "Observations of Precision with the Sextant" *(continued).* "Vocabulary of Powders and Modern Explosives." "Shipwreck of the cruiser 'Sanchez Barcáiztegui.'" "Naval Chronicle, Home and Foreign." "Notices of Books."

MILITARY.

AMERICA.—*Journal of the Military Service Institution.* September.—"The Army and the Civil Power," by Lieutenant Wallace. "The story of a rescue," by Colonel Carpenter; an interesting chapter of frontier experiences. "Sea coast artillery," by Captain Reilly. "Fortifications and field operations," by Colonel Egbert. "Our present artillery armament," by Lieutenant Birkhimer. "The man behind the gun," by Captain Walker; some practical hints on the maintenance and inculcation of discipline. "The bicycle as a military machine," by Lieutenant Hill; discusses practical points with regard to the length of columns of cyclists on the march, and deserves close attention. "Martial law in Ceylon," by Lieutenant Carbaugh. "Recruiting and Training of the Company," by Lieutenant Miller. The notes and comments are, as usual, most interesting.

AUSTRIA-HUNGARY.—*Organ der Militair-wissenschaftlichen Vereine.*—"The Fire of Double Lines of Guns in the Field"; sees no serious objection to this employment in tiers. "Military Clothing and how to judge it"; a technical but very interesting article on the nature of the different materials in use. "The Passage of Swamps"; practical suggestions.

FRANCE.—*Revue de Cavalerie.* September.—"Memoir by General Préval on the Organisation of Cavalry (1811)"; interesting chapter on the evolution of cavalry. "Instruction and leading of Cavalry"; translation from the German of Lieut.-General von Pelet-Narbonne. "Rezonville"; a detailed study of the cavalry movements on the 16th August; compare Kunz, "Die Deutsche Reiterei." "The Austro-Hungarian Cavalry"; an Italian opinion. "The Cavalry Division of the Imperial Guard in the campaign in Italy, 1859." "The Fire of Mounted Men"; some Russian views on the subject. "The Hussar Brigade 'von Sohr' from Ligny to Versailles, 1815"; an interesting article, translated from the German; von Sohr's brigade was cut to pieces in a desperate struggle in and around Versailles on the 1st July, 1815.

Journal des Sciences Militaires. September.—"The situation in the Far East." "Frontiers and Fortifications of the Principal Powers—Switzerland," by M. Amphoux. "The Field-gun of the Future"; abstract of the views of Wille, Langlois, and Moch. "The Campaign of 1814"; by M. Weil (*continued*). "Changes in the Promotion of Officers." "Turenne and the French Army in 1674," by Captain Cordier (*concluded*). "Wissembourg, Frœschwiller, Chalons, Sedan, Chatillon, La Malmaison"; reply to criticisms in the *Spectateur Militaire* on certain articles which appeared in the *Journal des Sciences Militaires.* "The Training of a Company for Field Service"; a suggestive paper, worth reading.

Revue d'Artillerie. September.—"The Artillery Museum" at the Invalides, a sketch of its origin, rise, and progress. "Modern Fuses" (with two plates); an interesting summary of existing types. "The Corps of Artillery of France"; a most interesting historical summary. "The Breech-closing arrangements in the Skoda system of Q.F.'s" (with plate).

Revue Militaire de l'Étranger. September.—"The Russians on the Pamir"; summary of recent events (with map). "Portuguese possessions in East Africa and their native troops." "Military Service in the tribes of the Caucasus." "Greek Military Organisation." "The Lee-Metford rifle in the Chitral Campaign"; summary of opinion as to the stopping power of the bullet, taken chiefly from the *Pioneer Mail.*

Le Spectateur Militaire. 13th September.—"The Lessons of 1870," by a combatant, noting progress, but still room for more; quotes Stoffel's reports freely; decidedly worth reading. "Retiring Pensions for Officers." "The German Railways," from the *Militair-Wochenblatt.* "Crosses, Medals, and

Decorations." "The Height of the Infantry Soldier," protests against a further reduction. The present minimum is 5 feet 0·63 inch; the average for the past ten years has fluctuated from 5 feet 4·56 inches to 5 feet 4·9 inches, with a slight tendency to improve.

Revue du Cercle Militaire. 7th September.—"The Swiss Army in 1894"; *résumé* of the report addressed to the Federal Chambers last year. "Infantry and the Artillery Duel"; advocates the co-operation of infantry with the guns, by means of the long-range fire of skirmishers. "The Militia in England." "Madagascar." 14th September.—"The Grand Manœuvres" (with map); full and interesting account. "Madagascar" (with map). 21st September.—The above articles continued. 28th September.—"Reforms in the British War Office"; from English sources. "The Swiss Army in 1894."

L'Avenir Militaire. 3rd September.—"The Army Manœuvres"; discusses the theatre of operations. "Les Mauvais-Bons"; this is the title by which the men who are not fit for the ranks, but retained for employment in the regimental shops, are known. This article criticises their employment in 1894. "The Sanitary condition of the Madagascar Force." "Simplification of Accounts in war time." "Madagascar, summary of news from." 6th September.—"The Army Manœuvres in the Faucilles"; deals with problems of wood fighting. "The coming Gazette." "Non-Commissioned Officers' Messes." "The Army Manœuvres"; continued throughout the month—a detailed diary of events worth reading. "Madagascar." 10th September.—"In the Faucilles"; comments on the manœuvres. "Supply of Sub-Lieutenants for the Reserve." "Le Sou du Soldat"; discusses the project of a company to insure a small additional sum to the soldier during his service. "Madagascar." 13th September.—"In the Faucilles"; comments continued, well worth reading. "From Andriba towards Tananarive"; discusses General Duchesne's march. "Railway from Majunga to Tananarive." "Spies at the Manœuvres"; complains of the presence of unauthorised persons. "Madagascar." 17th September.—"Modern Naval Tactics"; comments on recent articles in *Engineering*." "Note on the *Folding* Bicycle"; see also *Revue du Cercle Militaire* for two last months. "In the Faucilles" (*continued*). 20th September.—"Military Justice"; leader on the case of Chedel, who died undergoing punishment in Tunis. A very severe indictment, cites also the cases of a man shot for throwing a button from his tunic at the President of a Court-Martial, and another also punished with death for refusing to take his medicine in hospital and upsetting it over the Apothecary Sergeant. "Borgnis-Desbordes and Zurlinden"; interview with the former, *à propos* of Madagascar. 24th September.—"In Madagascar." "Military Funerals." "Soldiers and Politicians"; warning its readers against the political purposes of the pessimists in the Press. "The new Musketry Instructions." "Madagascar." 27th September.—"The Raid on Tananarive." "The case of Chedel before the Court-Martial"; full report of the proceedings, should be carefully studied. This month's issue notes seven death sentences for insubordination, of which only one was commuted.

GERMANY.—*Militair-Wochenblatt.* 4th September.—"Reply to the article on 'Judging the results of field-firing trials'" (Major-General Rohne); a valuable contribution to the subject. "Lawn Tennis"; comments on the recent tournament at Homburg vor der Höhe, open to officers on the active list, highly appreciative of the game. "A Military Pass in 1680"; reprint of an interesting old document. 7th September.—"Obedience, Marching, Shooting"; worth reading. "Notes on the effect of the new bullets M/88"; results of experiences in Africa on men, game, and horses, agrees with Chitral observations. 11th September.—"The 25th Anniversary of Vionville-Mars la Tour." "Obedience, Marching, Shooting" (*continued*); good marching principally a consequence of the training of the will

power, not so much a matter of mere physical condition. 14th September.—"New Regulations for Military Cyclists." "The Cavalry Manœuvres in England" (Baron Salvi); highly appreciative of men, horses, and leading. "The Mobilisation of the Algerian Troops." 18th September.—"The Fortress Manœuvres before Paris, 1894." "Increase in the Active List of British Naval Officers." "The French Officers—Past and Present" (from French sources); interesting, should by compared with Colonel Knolly's (R.A.) article on British officers, in this month's *Blackwood*; the parallel is very close. 21st September.—"The Training of our Infantry for War"; warns against the tendency to overdo musketry instruction. "The Fortress Manœuvres before Paris, 1894"; worth study. 25th September.—"English Views on Strategy and the Defence of the Empire"; review of Mr. Spenser Wilkinson's works, agrees with the general principles laid down, but the writer seems hardly to have grasped the conditions of invasion. 28th September.—"The Prussian Army, 1744-45" (von Boguslawski); a comment on Hoenig's review of the latest volumes of the work on Frederic the Great's war, issued by the General Staff. Hoenig's review appeared in No. 73 of the *Deutsche Heeres Zeitung*; both should be read.

Neue Militärische Blätter. July and August.—"The non-commissioned officers of the French Army"; deserves most careful study. "Eckernförde," by Vice-Admiral Batch; an account of the naval operations in the Schleswig-Holstein Campaign of 1848-9. "The re-organisation of the French Artillery." "The conduct of rear-guard actions and smokeless powder." "Letters from France and Russia." September.—"English views on naval tactics"; a study of the R.U.S.I. Prize Essay for 1894. "The Russian railways in 1892-3-4"; an important summary of Russian progress. "The infantry attack in the Russian Army"; this article deserves translation, giving an unusual degree of insight into Russian tactical theory and practice." "The new law of promotion in the French Army, 13th January, 1895." "Letters from France and Russia"; these letters form a special feature of this publication, and always deserve most attentive study.

Deutsche Herres Zeitung. 4th September.—"General Wimpffen at Sedan," from *L'Écho de l'Armée*; an attempt to show how impossible it would have been to break through the Germans; eye-witness testimony; should be read. 7th September.—"On the growing importance of Numerical Superiority in War." 11th September.—"The Wars of Frederic the Great"; review by Hoenig of the new work published by the General Staff under this title; a more scathing indictment probably never appeared, even in the *Saturday Review*. "Infantry and Cavalry"; from the Russian of J. Grebenschtschikoff; nothing new. "Guns and Armour on the Yalu"; from the *Revue d'Artillerie*. "Remounts in the Russian Cavalry"; an inconclusive reply to the many unfavourable views recently published, from the *Russki Invalide*. "Sword Exercise in the Russian Cavalry"; note. 28th September.—"The Operations of the French Fleet on the German Coast, 1870"; worth reading; reminds us that the French Republic ordered its Admirals to bombard the open sea-coast towns—an order which was not obeyed.

Jahrbücher für die deutsche Armee and Marine. October.—"Friedrich von Hellwig and his raids"; a study of partisan warfare, 1792-1814 (*continued.*) "The operations of Great Armies during the beginning and end of the XIX. Century"; a thoughtful analysis of the changes in strategy due to the universal acceptance of the principle of the "Nation in Arms," as opposed to the old-fashioned "Dynastic" armies (*to be continued*). "Lebœuf and the French mobilisation of 1870"; based on the "Enquête parlementaire sur les actes du gouvernement de la défense nationale"; well worth careful study. "The Austrian Artillery during the last forty-five years"; a very interesting summary. "Some of the economical difficulties anticipated at the outbreak of war"; shows the interdependence of

European nations, and endeavours to forecast the influence of war on the course of trade. "The psychological side of military training"; a plea for individual education. "Letters from Russia." "Book Notices," etc.

SWITZERLAND.—*Revue Militaire Suisse.* September.—"Some pages of Swiss military history." "The concentration of troops in 1895."

NOTICES OF BOOKS.

Electric Motive Power: The Transmission and Distribution of Electric Power by Continuous and Alternate Currents, with a section on the Applications of Electricity to Mining Work. By ALBION T. SNELL, M.I.C.E., etc., etc. "The Electrician" Publishing Company, Ltd., Salisbury Court, Fleet Street, E.C., 1894. Price, 10s. 6d.

This is a valuable contribution to the already rich and rapidly-growing literature concerning electricity and its various applications. The task the author set himself was the production of a practical work on the transmission of power by electricity, such as would be of real value to practical men, avoiding all controversial points and elementary matter properly belonging to text books on electricity and magnetism. After a careful perusal of this treatise we may say without fear of contradiction that the aim of the writer has been most successfully attained, as might have been expected from one of such a wide range of experience in this department of electrical engineering.

The arrangement of the book in chapters, "each a monograph of one portion of the subject," with cross references for the student's guidance, is an admirable one, as also its further division into complete clauses or paragraphs, and greatly adds to its value as a practical work. In these days of work at high pressure, business men have no time to hunt over a whole treatise, in the hope of finding here and there just those hints of the matter which at the instant are of the utmost importance to them; the author has also avoided all display of mathematical gymnastics, the necessary calculations and formula being clear and simple, and inch-pound units being adopted. We think this is a step in the right direction, and that there is still scope for the reformers' labours in reducing the luxuriant terminology which is growing up around electrical science to reasonable limits, at least in works compiled for the use of practical engineers and foremen. An infinity of strange names of Greek and Latin origin may be admirably suited to medical science, and serve as a barrier against the meddling of the ignorant and uncultured; but it is to be deprecated in all engineering literature, where the practical has always been more or less independent of, and often prior to, the purely theoretical. At any rate, cultured engineers are doing most valuable service in bringing the conclusions and theories of eminent scientists within the intellectual capacity of their less favoured brethren by using condensed formulæ and simple language.

Chapter I. deals with the general plan of the electrical transmissions of power, comprising the source of power, the dynamo, the line, the motor, and the machines driven. Chapter II., the practical methods of designs for dynamo and motor, with a notice of Mr. Sayers' device for the prevention and control of sparking ("Proceedings of Electrical Engineers," vol. xxii., part 107). The tabulated form, sect. 13, p. 56, should be very useful to designers, and would be better filled in with a numerical example. Chapter III., the line; the theoretical conditions affecting the line loss; Lord Kelvin's law on the most economical area of conductor, which, the author says, "should be carefully attended to whenever the circumstances permit of its application, although the simple condition of fall of pressure may be of paramount importance and alone determine the gauge of wire and consequent copper loss." Aërial lines and underground leads are considered, as also different types of lightning arresters, with illustrations. Chapter IV., direct systems of transmitting power. Chapter V., single-phase alternators and alternate current motors. Chapter VI., transformers, in which a point of vital interest to

the general public is touched on at p. 249, as regards safety devices for transformer circuits; we quote the final paragraph:—"It is urged most strongly by most of the leading electrical engineers, that the secondary circuit should always be earthed as well as the primary. If this were generally practised, it would be impossible for a plant with defective insulation to remain in connection with the high-pressure circuit, for the main fuses would blow out as often as the main switches were closed. *With the existing compulsory regulations, it is possible for a bad earth to exist in an installation until a second earth reveals its existence possibly by a fire.*" Chapter VII., single-phase alternate current transformers and distributors, and alternate current motors. Chapter VII., polyphase alternate current working; these are all dealt with in an able, concise, and practical manner, and are sufficiently and clearly illustrated. Chapters IX. and X. are on the transmission of power in mining operations, and coal drilling by electric power, and appear to have been a labour of love to the author. They are very interesting, and will doubtless give considerable impulse to the development of electrical power transmission and the use of electrical machinery in this department.

Speaking of the motors for mining work the writer says:—"The only safeguard from sparking at brushes and commutators (sliding contacts) is to do away with them altogether, and the only way in which this is practicable at present is by the use of polyphase motors. The mechanical simplicity and excellent speed regulation of these machines have already been urged, and these advantages, together with their safety, must gradually tell. The revolving part of the future motor will have no electrical connection with the supply mains, and will resemble an iron cylinder with closed ends and a steel shaft. A breakdown of the insulation inside the cylinder will simply affect the efficiency; *it will not cause sparking.* An explosion from an inadvertent spark may be made a most remote contingency than one from a safety lamp."

As of interest in relation to the development of electrical power work in war-ships, we may quote the author's opinion, p. 137:—"It is probable that secondary batteries will be found profitable for simple power work in some cases, and for combined light and power they are certainly always worth serious consideration. *The author believes strongly in the future of the storage battery, and insists upon its importance in all direct-current installations where the output is intermittent or the load factor small.*" It is stated, p. 347, that a colliery is being opened out (October, 1894) near Eckington, in which the whole of the work will be done by electricity, even to the driving of the fan. The coal will be worked on the pillar and stall system by Jeffery coal cutters. The undertaking is due to American enterprise, and will be watched with the highest interest. We congratulate the author on the result of his labour, and confidently recommend his book to all in any way interested in the subject of which it treats. We think, however, that a work of this description should be bound in a manner that would enable it to stand rough usage; which does not appear to be the case with the present edition. T. J. H.

Kriegführung: Kurze Lehre ihrer wichtigsten Grundsätze und Formen, von Colmar. Freiherr von der Goltz. Berlin: Decker, 1895. Price, 5s.

This little book should prove invaluable to all whose business or inclination leads them to concern themselves with the true principles which must guide a nation or its leaders in the conduct of warlike operations. Accurately this would include every individual in the whole nation, men, women, and children, all indeed whose lives and property may be affected by national disaster; but more narrowly it may be taken to mean all soldiers, politicians, and pressmen (including magazine writers), who endeavour to influence public opinion through the usual channels available to them. The danger every one included in the above categories has

particularly to guard against is the tendency, in working out any particular line of thought, "to lose sight of the wood because of the trees," and in this work of von der Goltz's will be found the best protection yet available, always provided that they can study it in its original language, for I defy any living German or Englishman to paraphrase it into language which shall convey its precise meaning.

Any man who has ever devoted much thought to military matters must be aware of the exceptional multiplicity of variable factors on which events at any given moment depend, and of the fatal facility with which, after a time, the mind becomes absorbed in some one factor to the neglect of the others; indeed, no better standard to judge an author by can be suggested than to note the number of these variables with which he deals, and the accuracy with which he maintains due proportion between them, and the same will apply in appraising the merits of an executive officer. The only way to protect oneself against this tendency, is from time to time to review the whole scope of the art of war—a proceeding which, owing to the multiplicity of the works in which its principles are contained, demands both time and labour, which few can spare from their daily avocations.

Realising these difficulties, von der Goltz has set himself to supply a convenient summary of the art of war as at present practised, by means of which every man may refresh his memory, and by a few hours' labour restore the facts existing in his memory into the proper order of their relative importance, and in this task he has succeeded in an altogether exceptional degree.—F. N. M.

Memories and Studies of War and Peace. By ARCHIBALD FORBES. London: Cassell and Co., 1895. Price, 16s.

A book we can most warmly recommend, as containing eye-witness testimony of many important occurrences in the campaigns of the past twenty-five years, together with opinions on current military problems which, in view of the exceptional opportunities and the experience of the author, deserve most careful consideration. But, nevertheless, we must issue one warning to the intending reader. The book is primarily written for the public, not for experts, and the public care nothing for that relative accuracy of appreciation on which all true military criticism depends. They like their sensations hot and bloody, and Mr. Forbes wisely considers their desires. Every page should be studied in connection with the official lists of the killed and wounded, and the results then correlated in the order of their respective magnitude. The description of the fighting round Gravelotte should be compared with Hoenig's "Twenty-four hours of Moltke's strategy," the chapters on the Turkish War with Kouroupatkine, Pfeil, and Herbert; and, when all these tests have been applied, we venture to assert that the net result will be to make the student admit that the average standard of accuracy attained by Mr. Forbes is many degrees higher than hitherto reached by any living correspondent.

The Manufacture of Explosives: A Theoretical and Practical Treatise on the History, the Physical and Chemical Properties, and the Manufacture of Explosives. By OSCAR GUTTMAN, Assoc.M.I.C.E., etc., etc. Vol. I., 350 pages, with 147 illustrations. Vol. II., 420 pages, with 181 illustrations. Published by Whittaker and Co., 2, White Hart Street, Paternoster Square, London. "The Specialists' Series," 1895. 42s.

These volumes are certainly all which the above title professes them to be, and they contain all that it is necessary for anyone to know of theory and practice in the manufacture of explosives. They are also well up to date, a good account being given of modern appliances and methods both home and continental, a task for which the author's exceptional position and wide experience render him

peculiarly fitted. The illustrations and text are both clear and well executed on good paper, the descriptions are as concise and practical as possible; approved methods of testing are fully treated of and well illustrated. We consider the book as a whole to be one of the best written and most useful theoretical and practical treatises on the subject of explosives which has yet appeared, and it will no doubt find a place on the bookshelves of every specialist in this department. T. J. H.

The Chitral Campaign: A Narrative of Events in Chitral, Swat, and Bajour. By H. C. THOMSON. With fifty-nine illustrations, plans, and map. London: Heinemann, 1895.

We can warmly congratulate Mr. Thomson on the excellent use he has made of his opportunities. The book is readable from cover to cover, the information singularly accurate as far as we are able to judge; and though the author disclaims any special knowledge of military matters, he has succeeded in describing the fighting incidents of the campaign with a clearness which leaves nothing to be desired. The bird's-eye views of the ground on which the different encounters took place bring home to the average reader the nature of the *terrain* far better than the ordinary topographical sketch, which is hardly adapted for rendering the unusual features of these great mountains in a manner intelligible to those unacquainted with them.

The Land of the Nile Springs: Being chiefly an account of how we fought Kabarega. By Colonel Sir HENRY COLVILLE, K.C.M.G., C.B., Grenadier Guards. London: Edward Arnold, 37, Bedford Street, 1895. Price, 16s.

This book can be most warmly recommended. Not a line need be skipped, the author's inexhaustible good spirits and cheeriness hold one's attention to the end, and in spite of the very unofficial style in which he indulges, he yet conveys an immense amount of really valuable information to the reader, though to our mind he fails altogether to do even approximate justice to his own achievements. It will be found very interesting to compare his work with the "Hints on African Warfare and Exploration," by Wissmann, recently published in the *Militair-Wochenblatt;* and the accounts of French and Belgian explorers may also be consulted with advantage.

Information in War: Its Acquisition and Transmission. By Colonel G. A. FURSE, C.B. London: Clowes and Sons, 1895.

Waterloo: A Narrative and a Criticism. By E. L. S. HORSBURGH, B.A. London: Methuen and Co., 1895. Price, 5s.

Sir Richard Church: Chapters of an adventurous life in Italy and Greece. By E. M. CHURCH. London: Blackwood, 1895. Price, 15s.

THE JOURNAL

OF THE

ROYAL UNITED SERVICE INSTITUTION.

NOVEMBER.

THE RETIREMENT OF FIELD-MARSHAL H.R.H. THE DUKE OF CAMBRIDGE, K.G., &c.

TO the regret experienced by all ranks of the military forces of this country, and the public generally, at the retirement of His Royal Highness from the post of Commander-in-Chief of the British Army, suitable expression has been given.

His Royal Highness, who is first cousin to Her Majesty the Queen, was born at Hanover on 26th March, 1819, and is the son of the late Field-Marshal H.R.H. the First Duke of Cambridge, Colonel of the Coldstream Guards, and Colonel-in-Chief of the 60th (King's Royal Rifle Corps).

He entered the British Army on 3rd November, 1837, when he obtained the brevet rank of Colonel. From 1838 to 1840 he was attached to the Staff at Gibraltar, and for a time to the 33rd Regiment, and later on did duty for a short period with the 12th Light Dragoons. On 15th April, 1842, he was gazetted Lieutenant-Colonel of the 8th Light Dragoons, and on the 25th of the same month became Colonel of the 17th Light Dragoons. From 30th April, 1843, His Royal Highness was employed as Colonel on the Staff in the Ionian Islands, until his promotion to the rank of Major-General on 7th April, 1845. From 1st October, 1846, until 31st March, 1852, he served in command of the Dublin District; and from 1st April, 1852, until 20th February, 1854, as Inspector-General of Cavalry at the Headquarters of the Army, having on 28th September, 1852, been appointed Colonel of the Scots Fusilier Guards. On 19th June, 1854, he obtained the rank of Lieutenant-General.

His Royal Highness served during the Eastern Campaign of 1854-55. In command of the 1st Division he was present at the battles of Alma and Balaklava, the sortie of 26th October, 1854, the battle of Inkerman (horse shot), and the siege of Sebastopol. For these services he was three times mentioned in despatches, received the thanks of the House of Commons, the Crimean Medal with four clasps, the Turkish Medal, and the French Military War Medal.

On 16th July, 1856, His Royal Highness was appointed Officer Commanding-in-Chief the Forces with the rank of General; and in the same month was introduced at the Privy Council; on 10th May, 1861, he became Colonel of the Royal Artillery and Royal Engineers; and on 9th November, 1862, was promoted to the rank of Field-Marshal; being further appointed on 3rd March, 1869, Colonel-in-Chief of the 60th (King's Royal Rifle Corps), and on 21st June, 1876, Colonel-in-Chief of the 17th Lancers. His Royal Highness is also Honorary Colonel of the Royal Malta Artillery, the 4th (Militia) Battalion Suffolk Regiment, the Middlesex Yeomanry Cavalry, and the London Rifle Volunteer Brigade. He is President of the Royal Military Academy, Woolwich, the Royal Military College, Sandhurst, and a Commissioner of the Duke of York's Royal Military School. On 24th November, 1882, he was appointed Personal Aide-de-Camp to the Queen, and on 26th November, 1887, in celebration of the Jubilee of Her Majesty, was appointed, by patent, Commander-in-Chief of the Army.

His Royal Highness has been for over forty years closely associated with the Royal United Service Institution, and has always evinced a warm interest in its affairs. He was appointed a Vice-Patron in 1852, and presided at the annual meeting held in 1855. With his distinguished father he contributed to the purchase of the Waterloo Model; and on the death of General Lord Hotham, in 1870, became President of the Institution. He signed, on behalf of the Council and Members, the memorial to the First Lord of the Treasury, urging on the Government the claims of the Institution to a permanent site on its having to surrender the old building; and took a prominent part in the acquirement of the premises in which the Institution is now located.

On His Royal Highness handing over to Field-Marshal Viscount Wolseley, on 31st ultimo, the office of Commander-in-Chief, the Queen was pleased to appoint him Honorary Colonel-in-Chief to the Forces, and her Chief Personal Aide-de-Camp.

The following is a copy of the Farewell Order of His Royal Highness on relinquishing the command of the Army :—

ARMY ORDER.

SPECIAL.

WAR OFFICE, 31st October, 1895.

Field-Marshal His Royal Highness the Duke of Cambridge, K.G., relinquishes to-day the duties of the command of Her Majesty's Army, a post of honour and distinction which he has held since the 16th July, 1856.

His Royal Highness has for nearly fifty-eight years held Her Majesty's commission, and he now severs his connection with the active duties of his profession with the deepest sorrow and regret. In relinquishing these duties His Royal Highness desires to place on record the obligations he is under to all General and other officers who have so uniformly and ably assisted and supported him in maintaining the Army in the high state of discipline and efficiency for which it is distinguished, and he desires to express his deep sense of the admirable conduct, both in the field and in quarters, invariably displayed by officers, warrant officers, non-commissioned officers and men of the active service over whom he has so long presided.

The period covering His Royal Highness's command of the Army has been one of great changes. The abolition of purchase, the introduction of short service, of the territorial system, and of improved arms and equipments have all been materially assisted in their development by the cordial co-operation of all ranks of the officers of the Army.

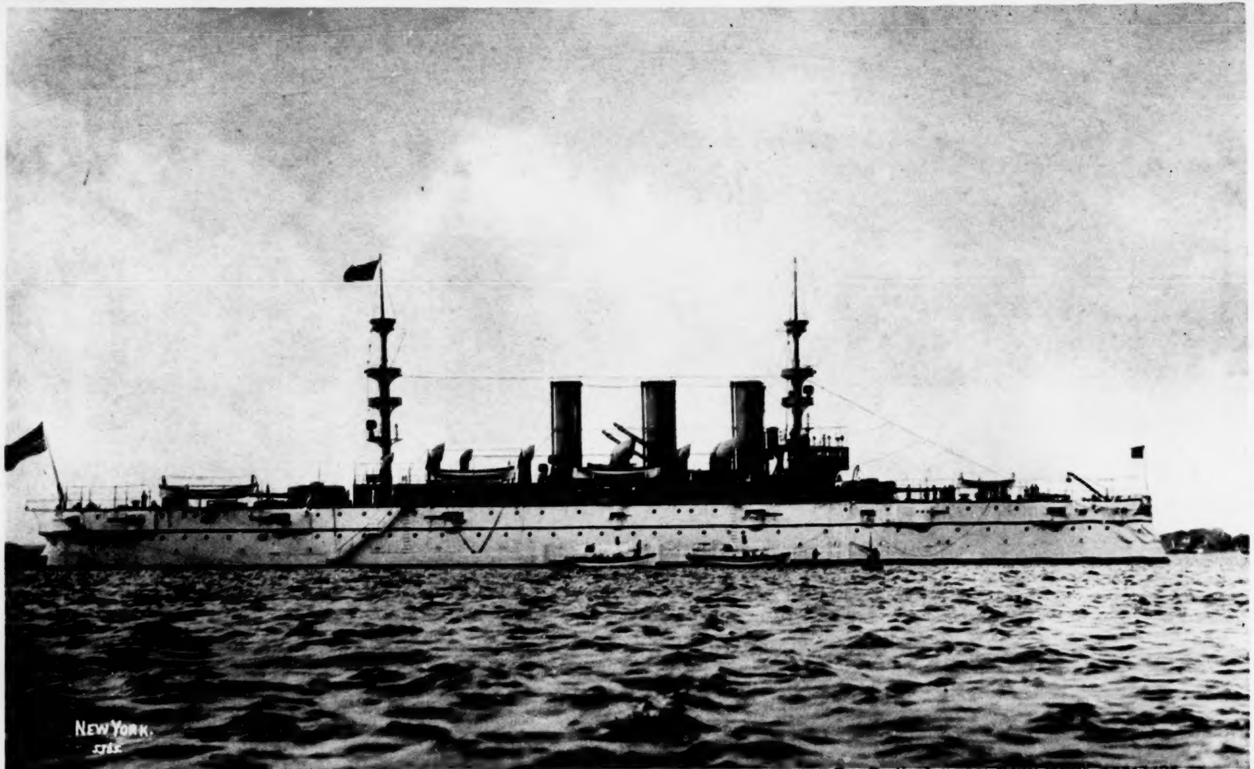
The Militia have been brought into closer connection with the line, the Yeomanry have become far more efficient, and the institution of the Volunteer Force in 1859 marked an important epoch in the expansion of the defensive resources of the Empire. By constant attention to their duties and the desire to perfect themselves in practical knowledge of the military profession, all the Auxiliary Forces, including the Volunteers, have become a valuable portion of Her Majesty's Army.

In India, also, most important military changes have been effected, commencing with the amalgamation of the late East India Company's troops with Her Majesty's Army in 1860, since which time great changes have been arrived at in many details connected with the Army of India, concluding with the recent reorganization of the Presidential Armies into one command under the control of the Commander-in-Chief in India.

In bidding the Army an affectionate farewell the Duke of Cambridge feels assured he is handing over to his able and distinguished successor a force of which Her Majesty the Queen and the Empire at large may well be proud, and he assures the Army and the nation that though relinquishing his active duties his interest in and his devotion to the Service will continue to the end of his days.

By Command of His Royal Highness the Field-Marshal Commander-in-Chief.

REDVERS BULLER, A.G.



J. J. K. & Co., LONDON.

For Particulars, see Naval Notes, page 1,135.

The United States New Armoured-Cruiser "NEW YORK," 8,500 Tons, 16,500-I.H.P.

PROGRAMME OF LECTURES.

WINTER SESSION, 1895.

28th Nov. 5 p.m.—**The Tactical Training of Volunteer Officers,** by Lt.-Col. EUSTACE BALFOUR, *London Scottish R.V.*

11th Dec. 3 p.m.—**My Experiences during the Chino-Japanese War,** by Surg.-Col. TAYLOR, M.D., A.M.S.